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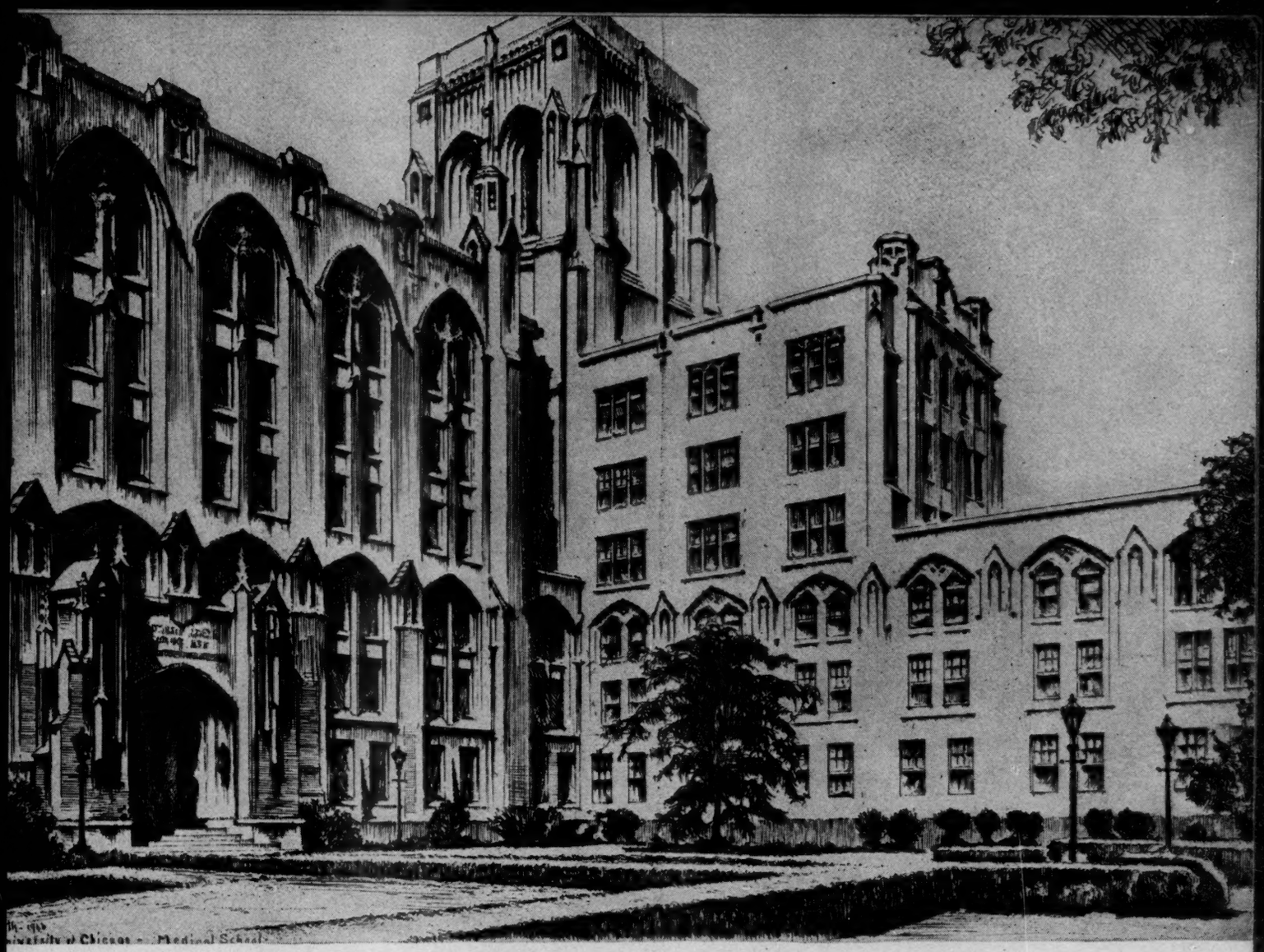

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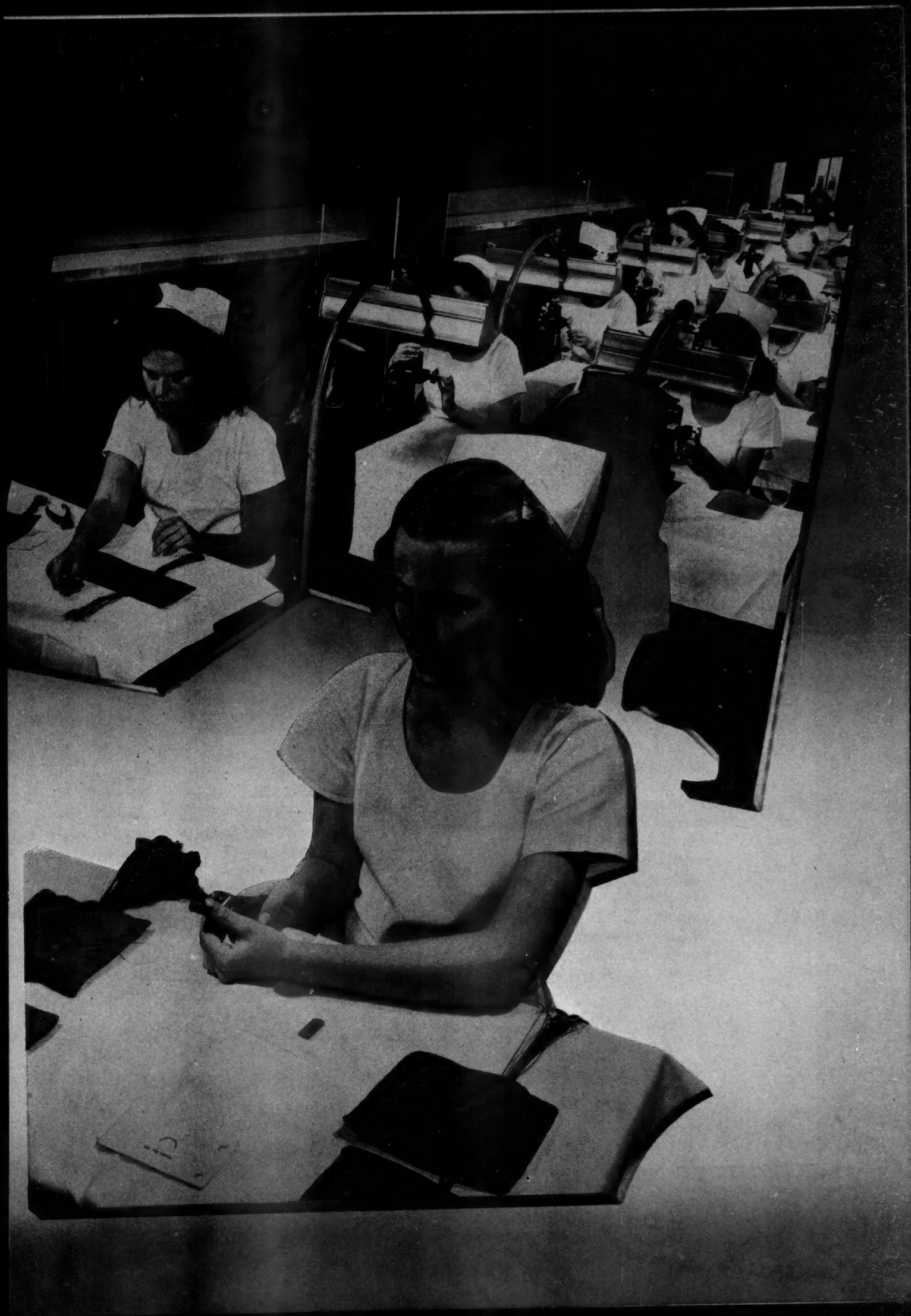

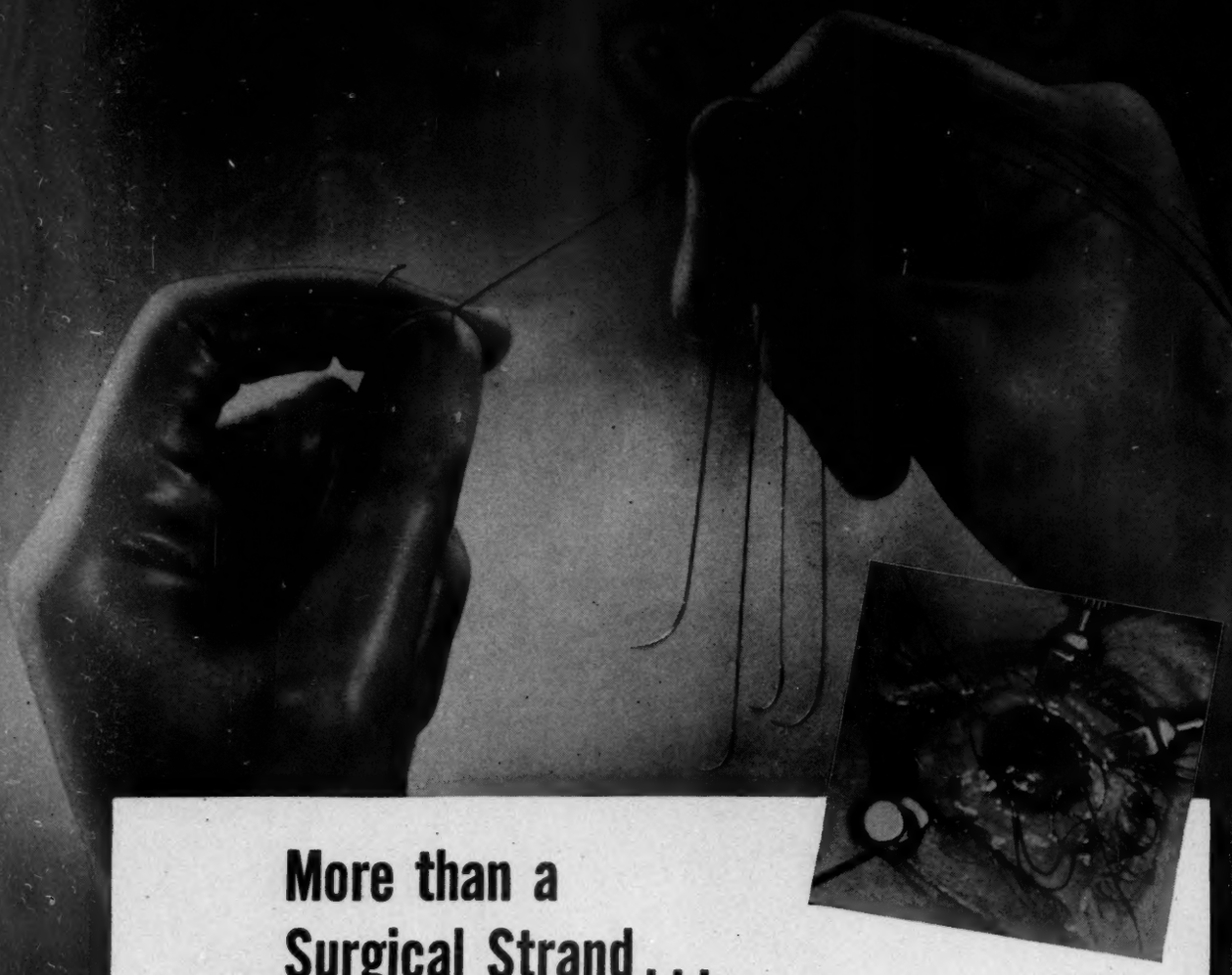

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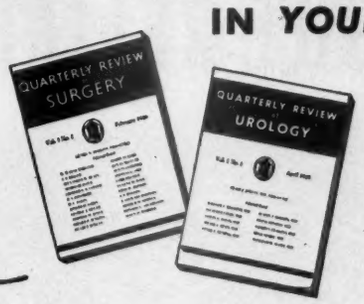

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*Whipple, A. O.: Critical Latent or Lag Period in the Healing of Wounds. Ann. Surg. 112: 481-488 (October), 1940.

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BIBLIOGRAPHY

1. Coller, F. A.: Review of Studies on Water and Electrolyte Balance in Surgical Patients. Surgery 12: 192-200 (July), 1942.
2. Maes, U., and Davis, H. A.: Therapeutic Problems in Water Balance from Viewpoint of the Surgeon. New Orleans M. & S. J. 94: 207-211 (November), 1941.
3. Morris, N.: Acidosis and Alkalosis. Practitioner 147: 486-492 (August), 1941.
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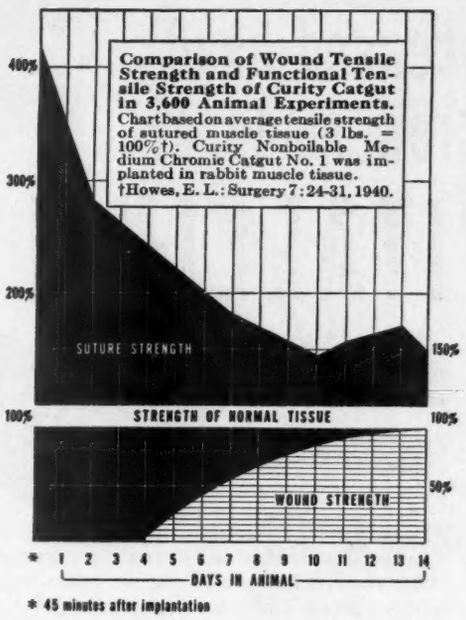
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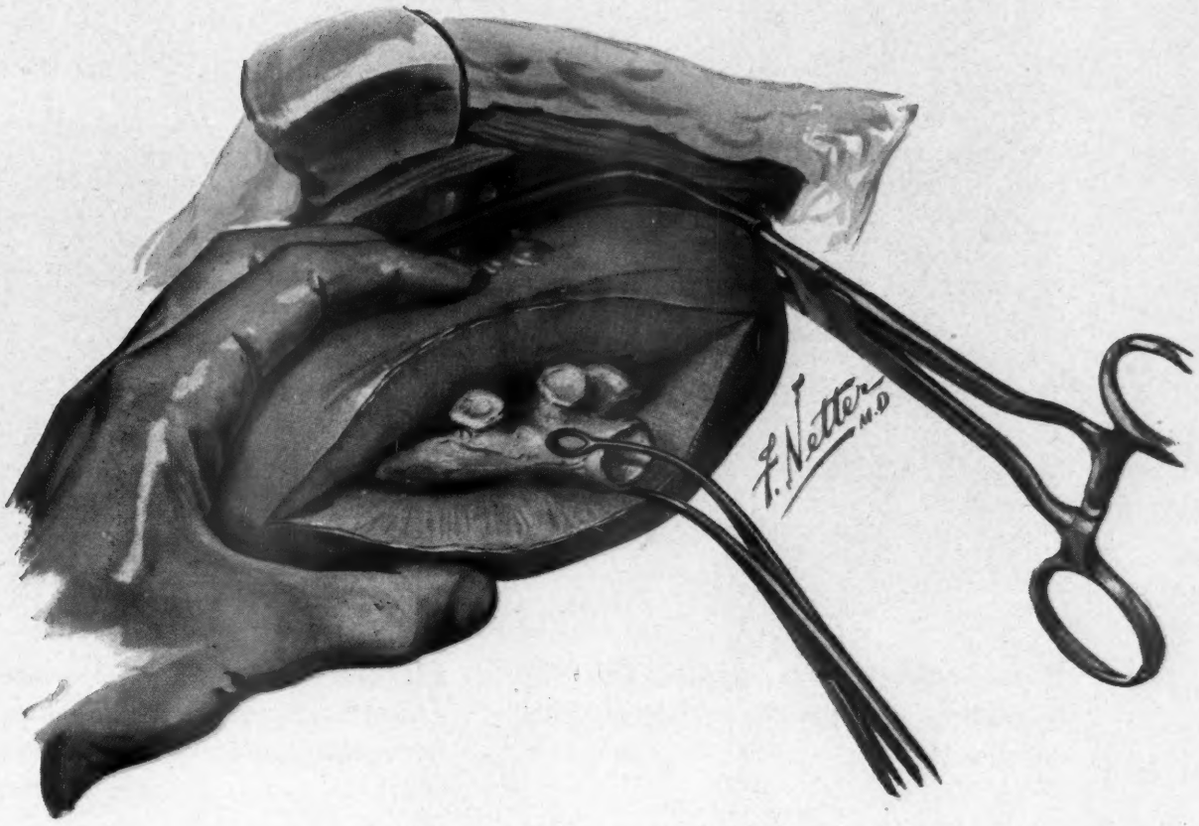

NEPHROTOMY for calculus

The removal of renal calculi without sacrificing the kidney is a procedure of utmost importance—for saving the kidney may mean saving a life. In the case illustrated here, for example, the opposite kidney has been previously removed.

In this operation, the surgeon is confronted with a physiological as well as a surgical problem, for he has in mind the maintenance of proper blood supply to the kidney, the minimizing of renal damage and the prevention of uremia as well as the technique of a difficult operation. The best in working materials is essential—thus eliminating any additional concern. Many surgeons prefer Armour sutures and ligatures, for they know that the name Armour designates the very best in quality. Surgeons have confidence in the tensile strength, uniformity and sterility of Armour surgical gut, and they like its excellent working properties—its pliability, flexibility, and good tying quality.

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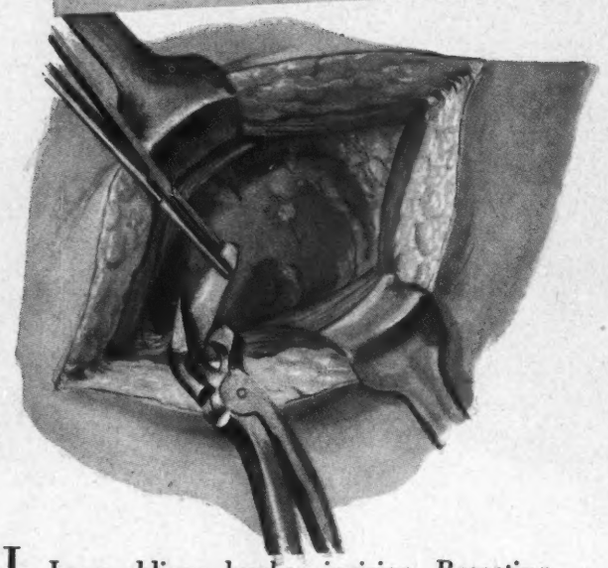
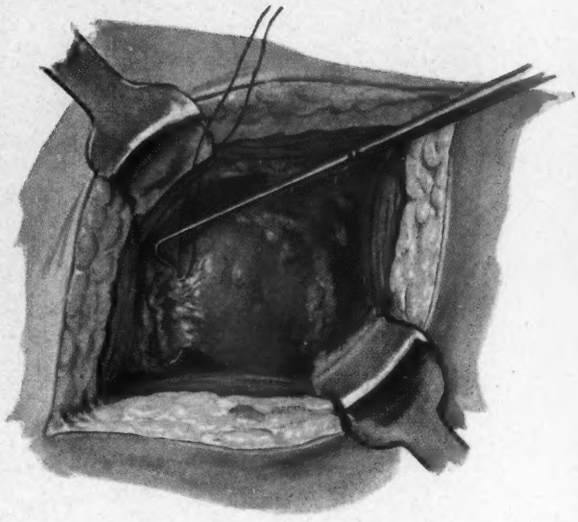
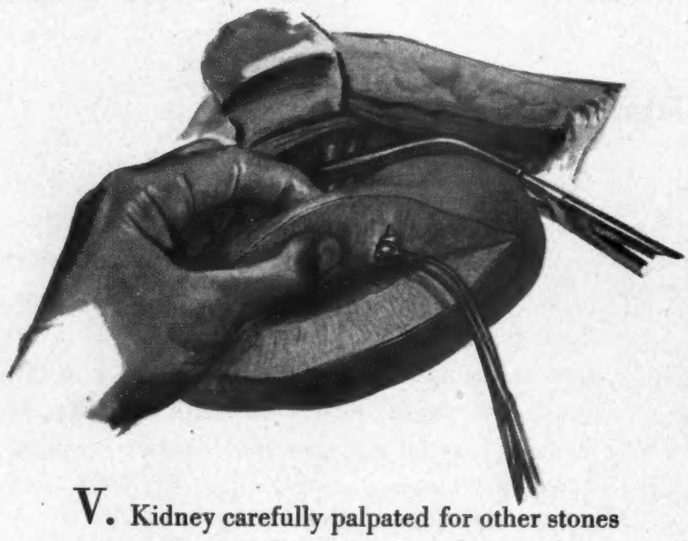


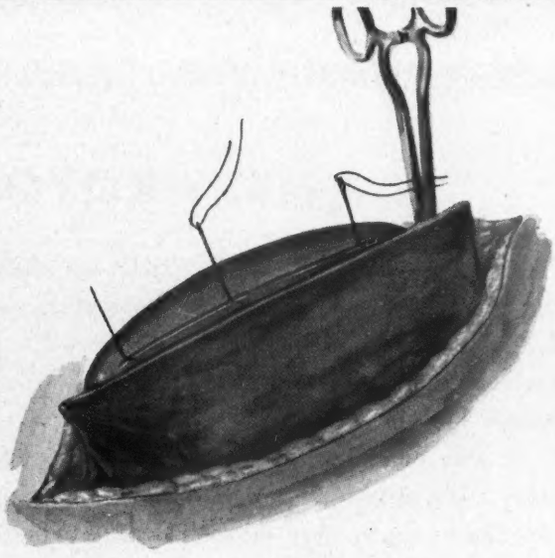
I. Long oblique lumbar incision. Resecting as much of 12th rib as necessary for good exposure.



II. Kidney exposed, freed from surrounding fat and adhesions. Upper pole separated from suprarenal gland and ligated.

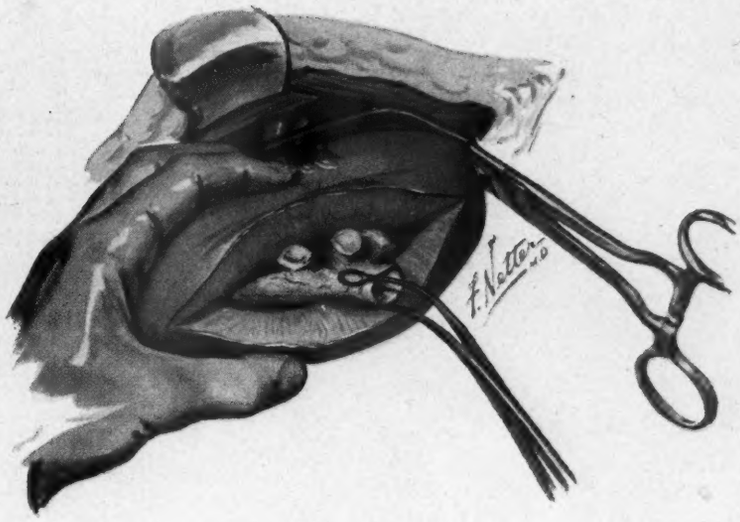


V. Kidney carefully palpated for other stones —large or small. These are removed by forceps or curette and kidney irrigated.

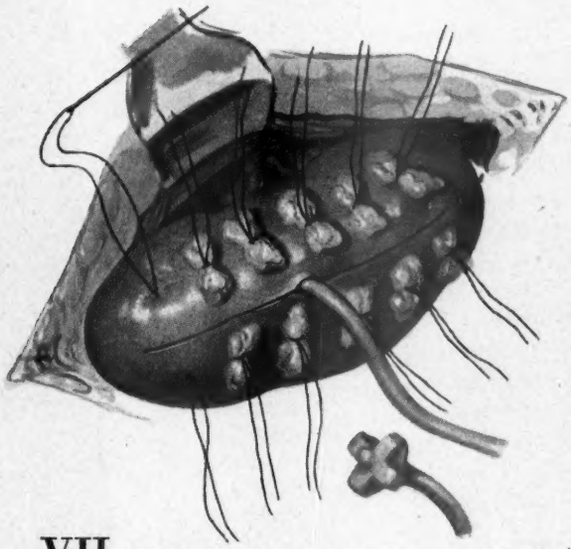


VI. Three needles placed in kidney (one, eye down; two, eye up) for localization. X-ray film wrapped in sterile rubber applied to kidney—picture taken and immediately developed. Hemostatic clamp loosened at intervals to permit some circulation.

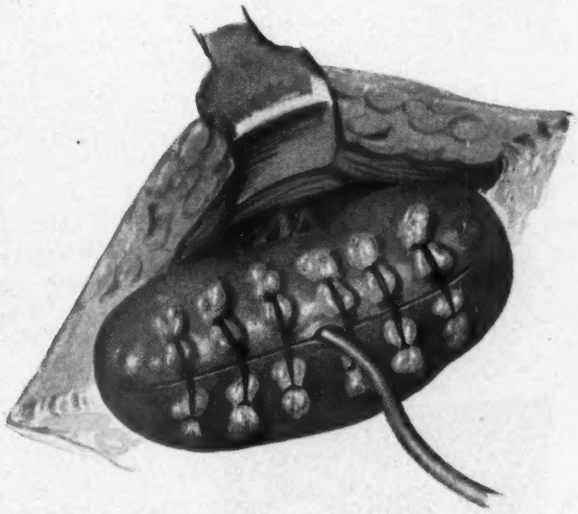
III. Temporary ligature placed around ureter (insert shows detail of ligature). As renal pelvis is too small for pyelotomy in this case, nephrotomy decided upon.



IV. Temporary clamp applied to renal vessels and tightened to control bleeding. Kidney incised—large stone being removed.



VII. If no stones are seen in x-ray, clamp is removed. Catheter inserted into renal pelvis. Chromic catgut sutures placed through kidney and tied over small fat pads. (Insert shows detail of catheter head.)



VIII. Free ends of previously placed sutures are tied. Kidney replaced, wound closed.

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In the "scrubbing up" operation, the surgeon often is unaware of the difficulties which may confront him later. What seems beforehand like a relatively simple procedure may, at the operating table, develop into an extremely difficult operation calling for the utmost skill, knowledge and courage. It is of vital importance therefore in performing surgery of any type, that the suture and ligature materials employed be of the very finest quality — thus eliminating any unnecessary burden on the operator.

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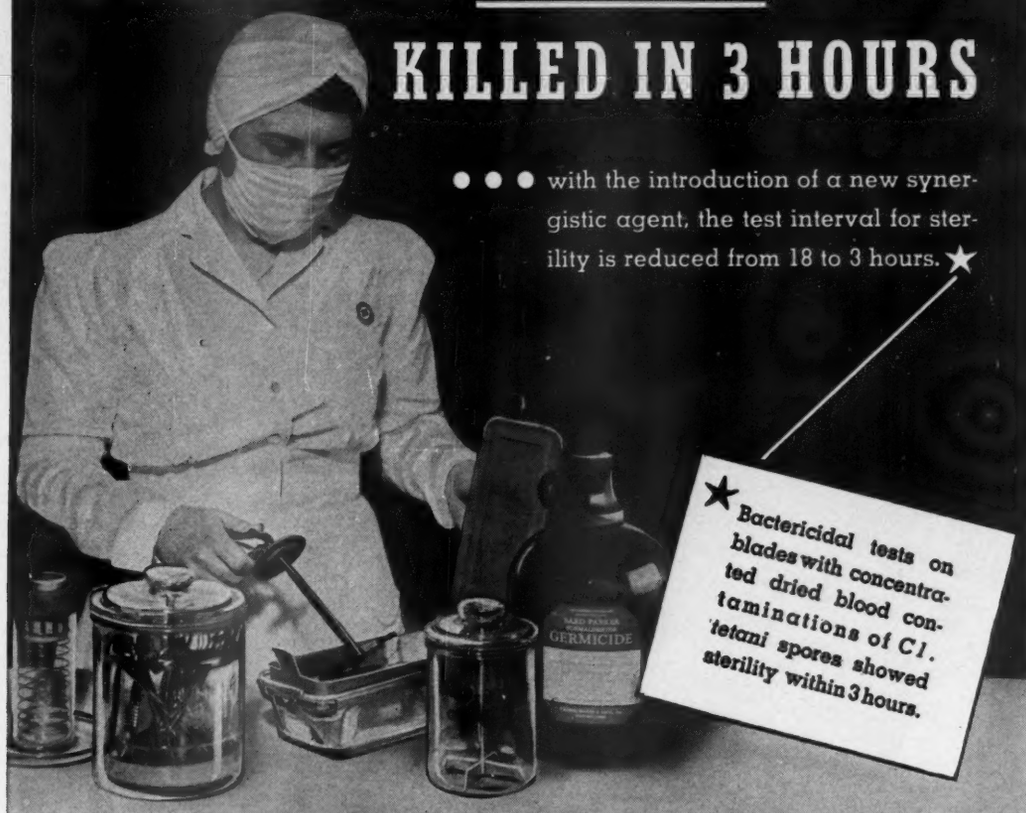

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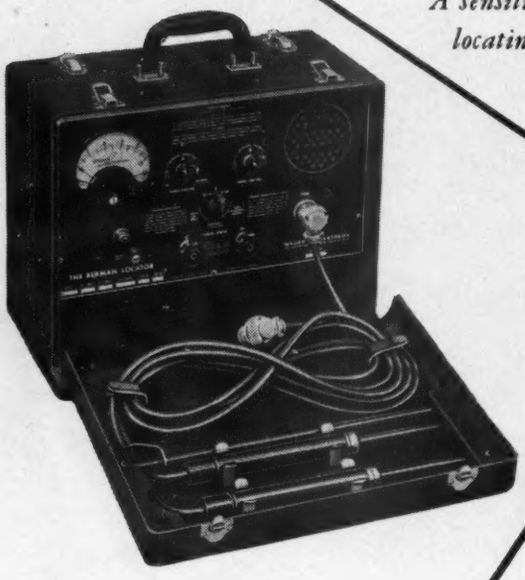

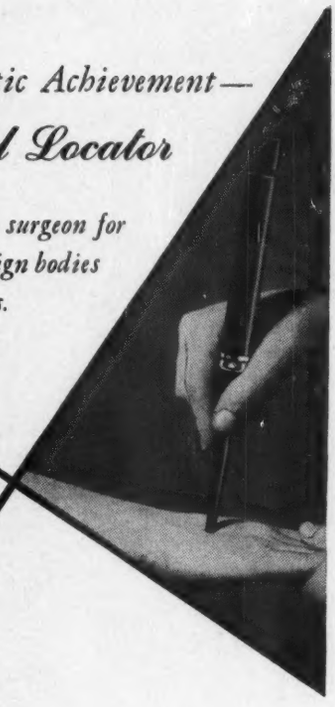

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Historical data, courtesy Picker X-Ray Corp.

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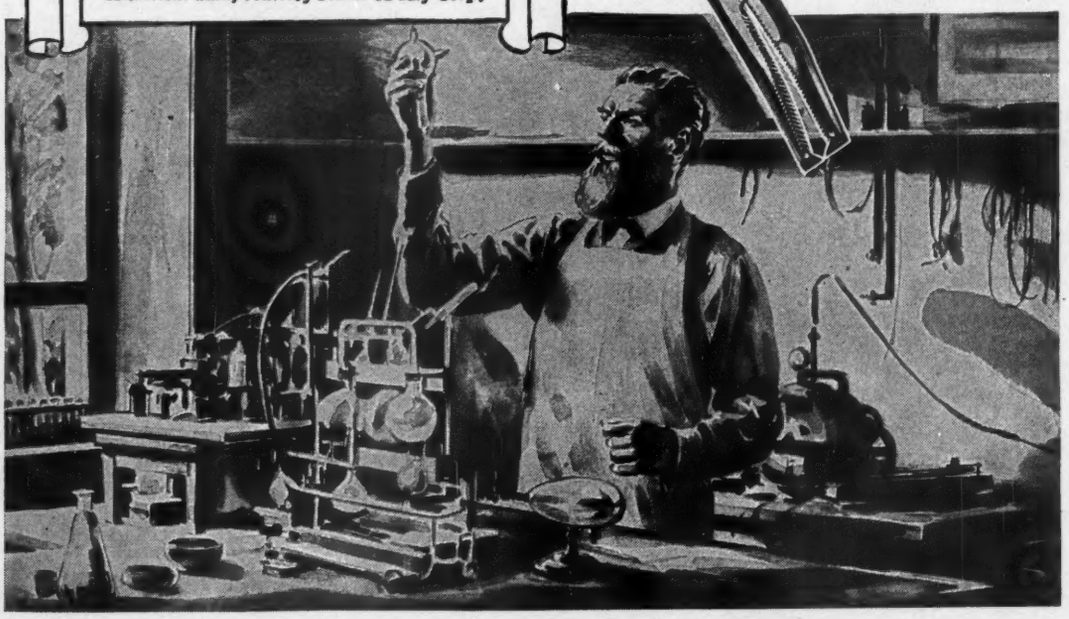

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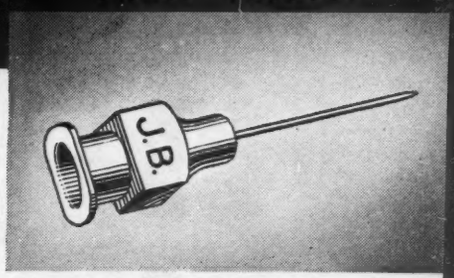

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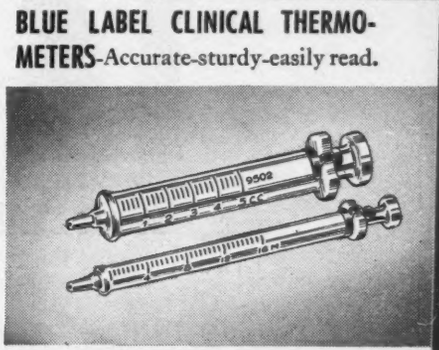

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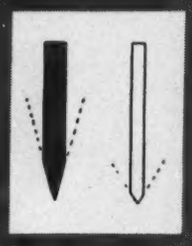

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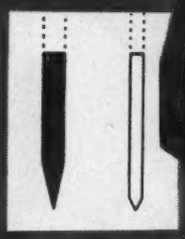

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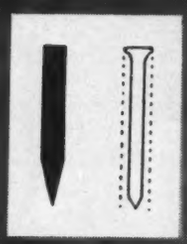

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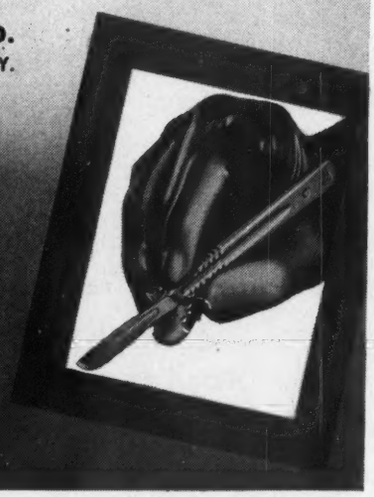

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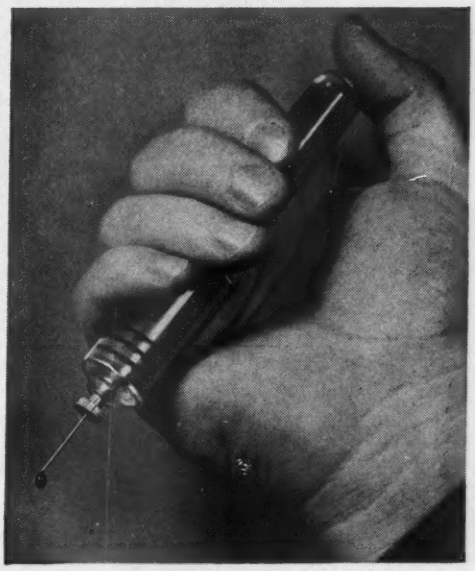

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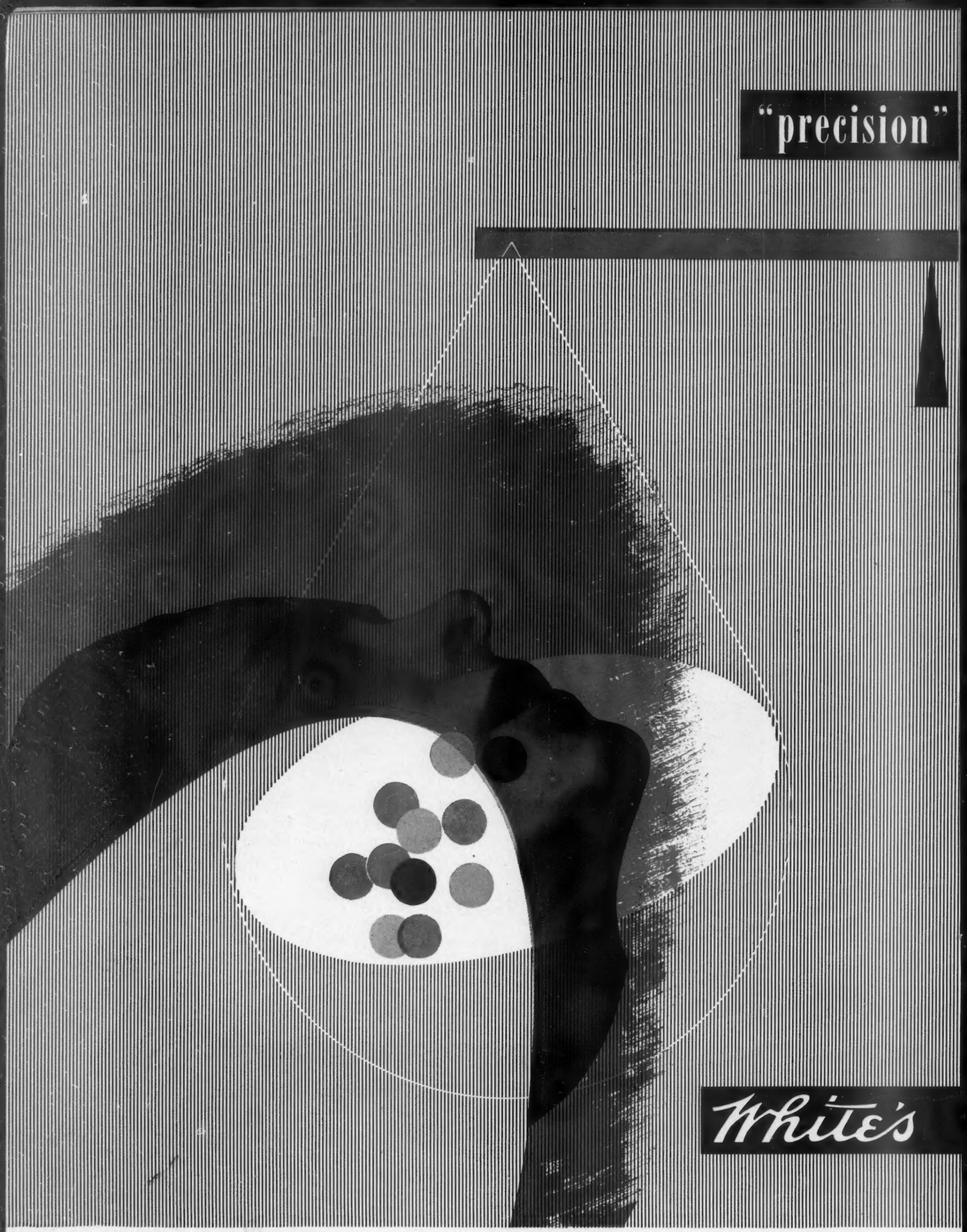

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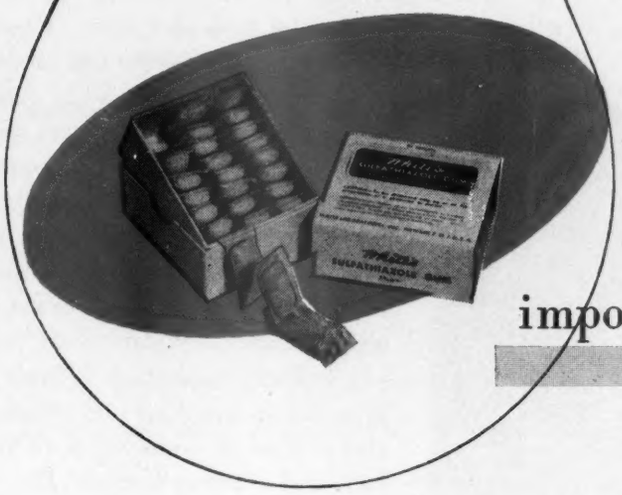

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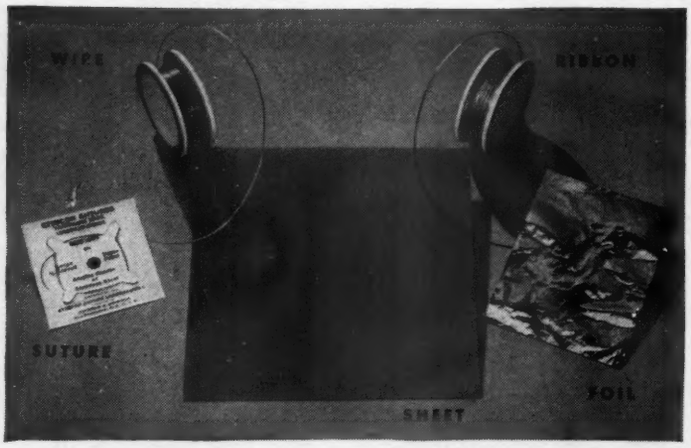

*Olson, C. T.: "The Place of Tantalum in Surgery," Industrial Medicine, 13: 917, November, 1944.

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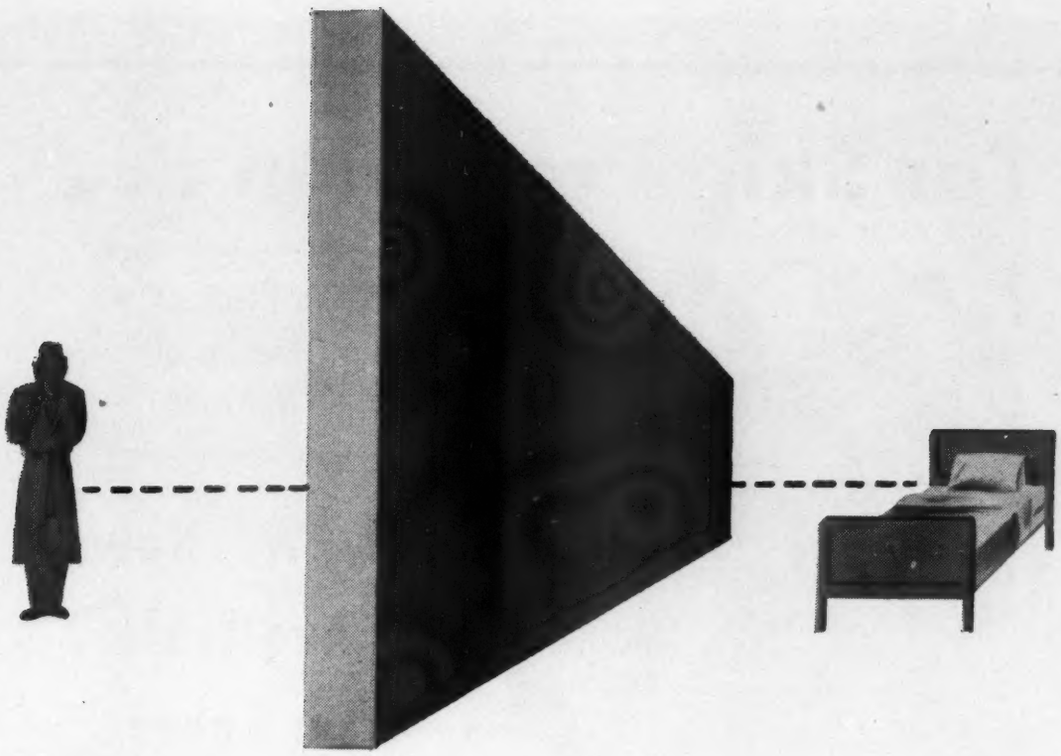

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*L. Goodman and A. Gilman, The Pharmacological Basis of Therapeutics, The Macmillan Company, New York, 1944.

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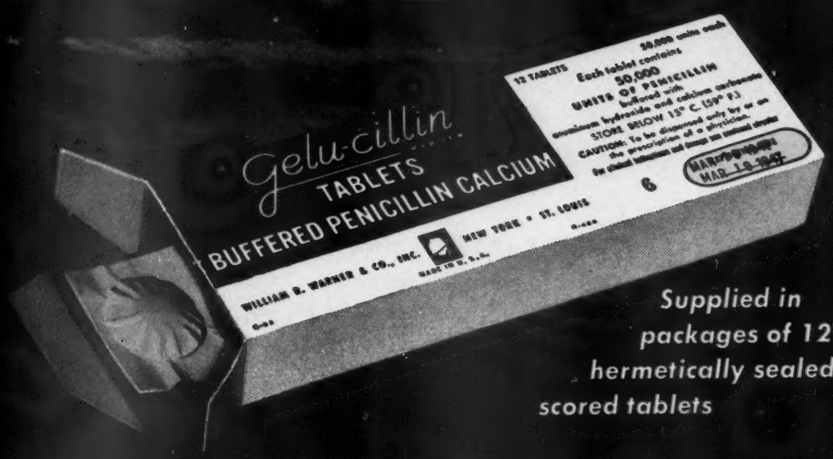

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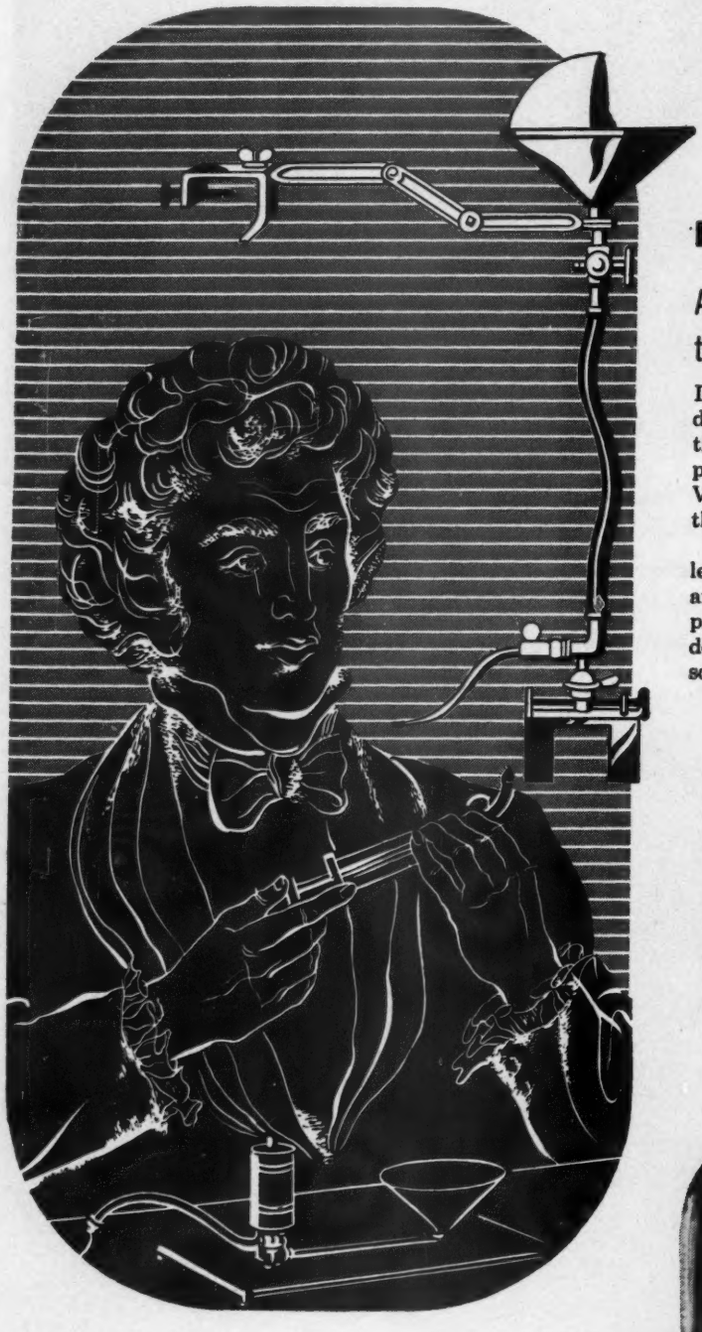

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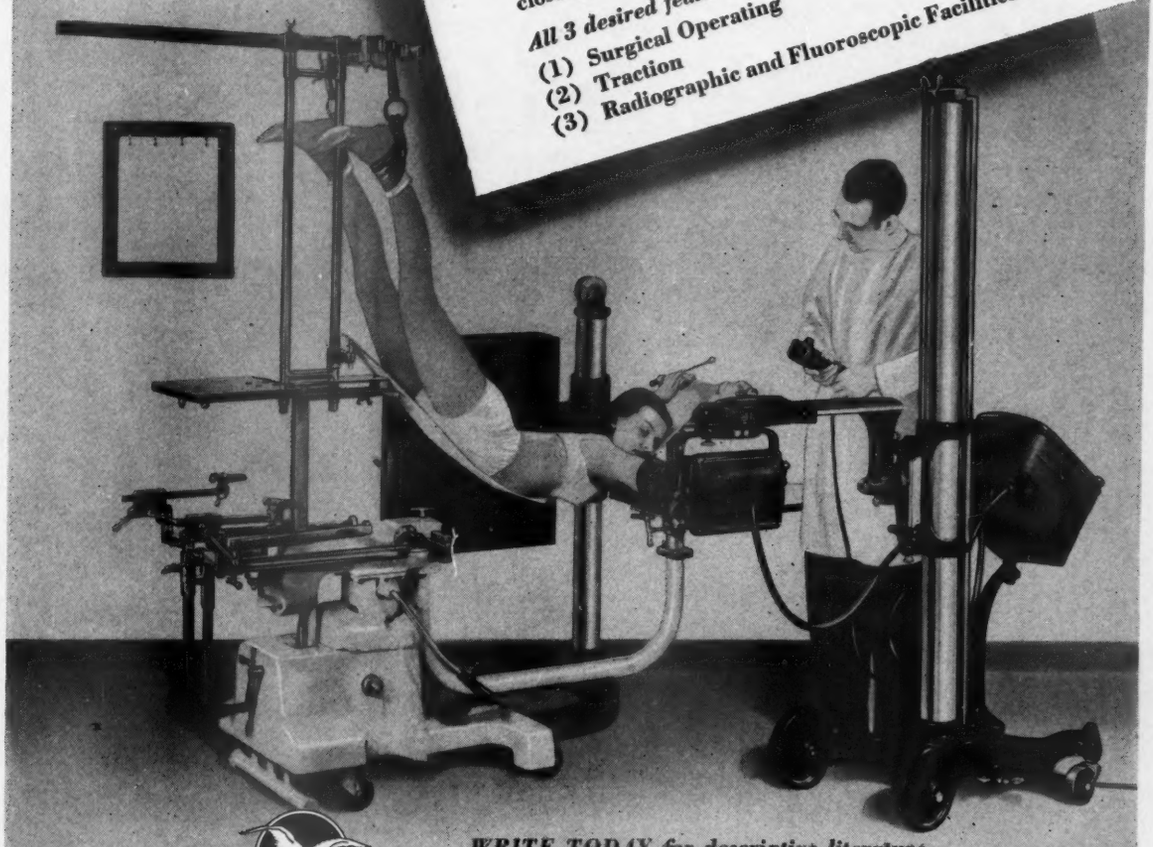

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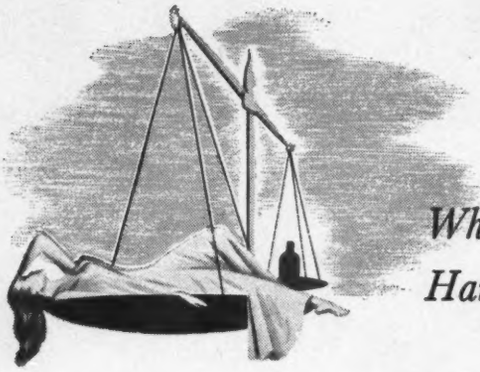

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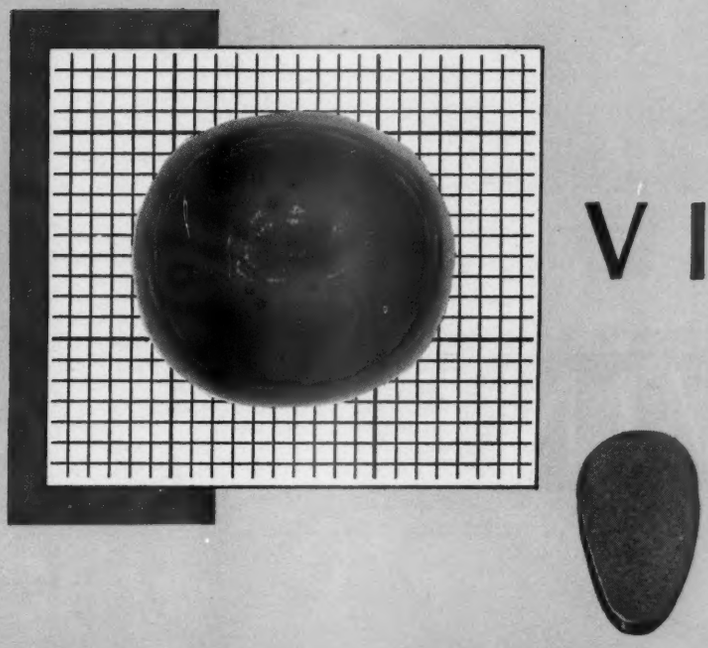

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Ringer's 500 cc		$.079	1944	$153.58
Ringer's 1500 cc		.092	2652	243.98
Ringer's 1000 cc		.084	5781	485.60
Normal Saline 300 cc		.061	2436	148.60
5% Hyper tonic Saline	200 cc	.066	228	15.05
15% " " "	500 cc	.083	30	2.49
5% Dextrose in Ringer	1000 ct	.105	2421	254.21
10% " " "	500 cc	.101	1713	173.01
2½% " " "	500 cc	.087	36	3.13
10% Dextrose in Distilled Water	1000 cc	.108	21	2.27
5% Dextrose Ditto	1000 cc	.100	15	1.50
4% Boric Acid 750 cc		.072	3786	272.59
2½% Sodium Citrate 100 cc		.063	1779	112.08
10% Sodium Lactate 500 cc		.206	111	22.87
Distilled Water 30 cc		.061	1086	66.25
Distilled Water 50 cc		.061	252	15.37
Distilled Water 500 cc		.065	720	46.80

HOW STERILIZED: Autoclave, 15 pounds 30 min. 250° F.

REACTIONS REPORTED: None

FACTORS used to compute unit cost:
1. Materials used in manufacture, sterilization and cleansing.
2. Supervisory and labor cost.
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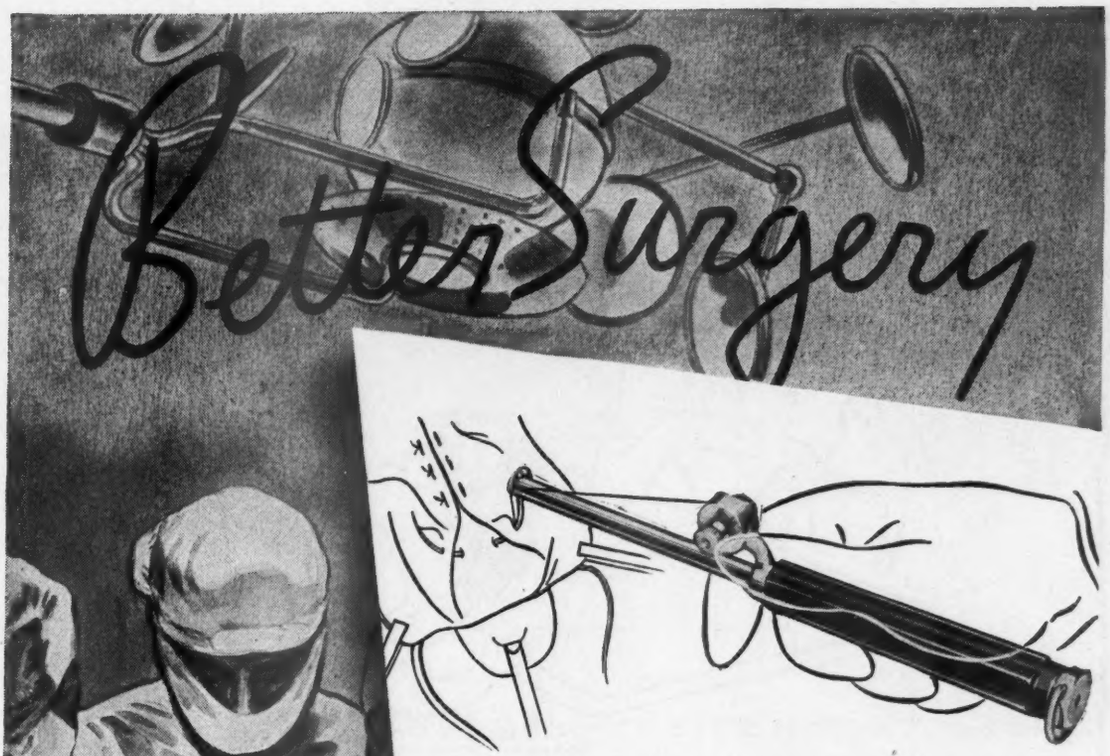

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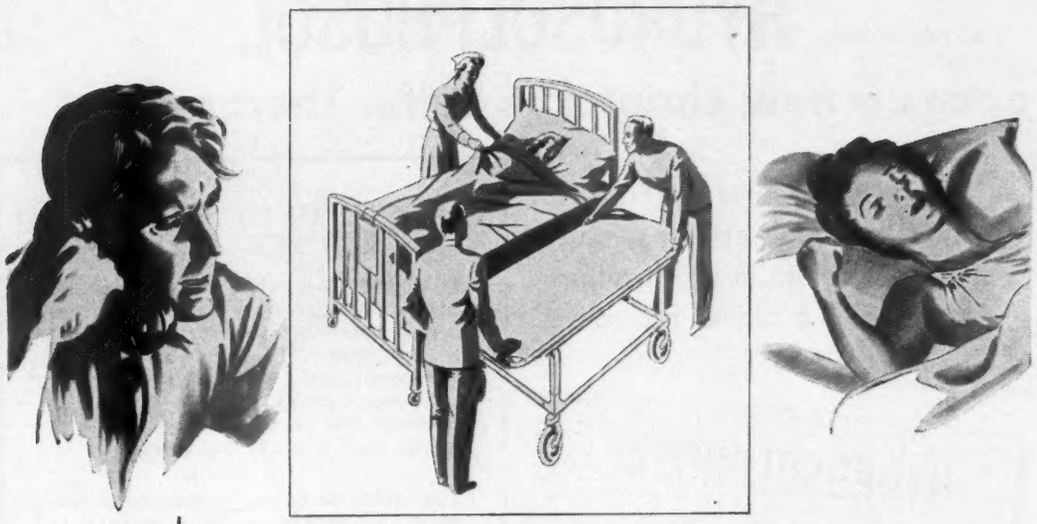

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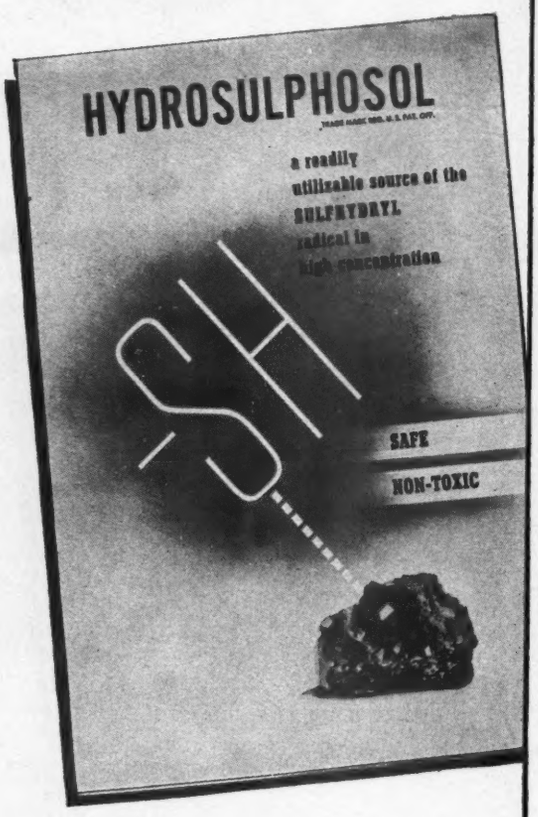

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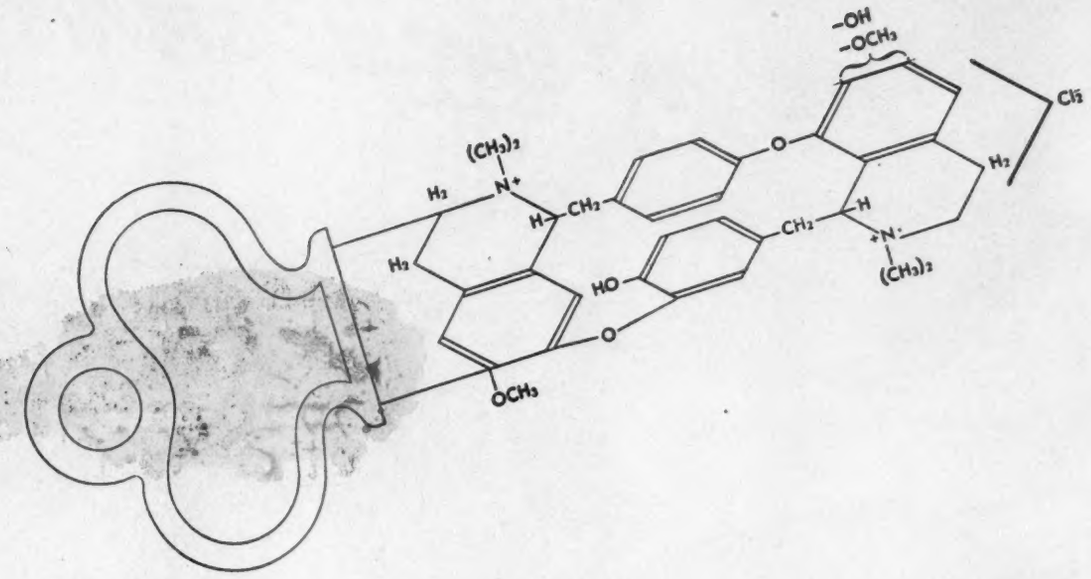

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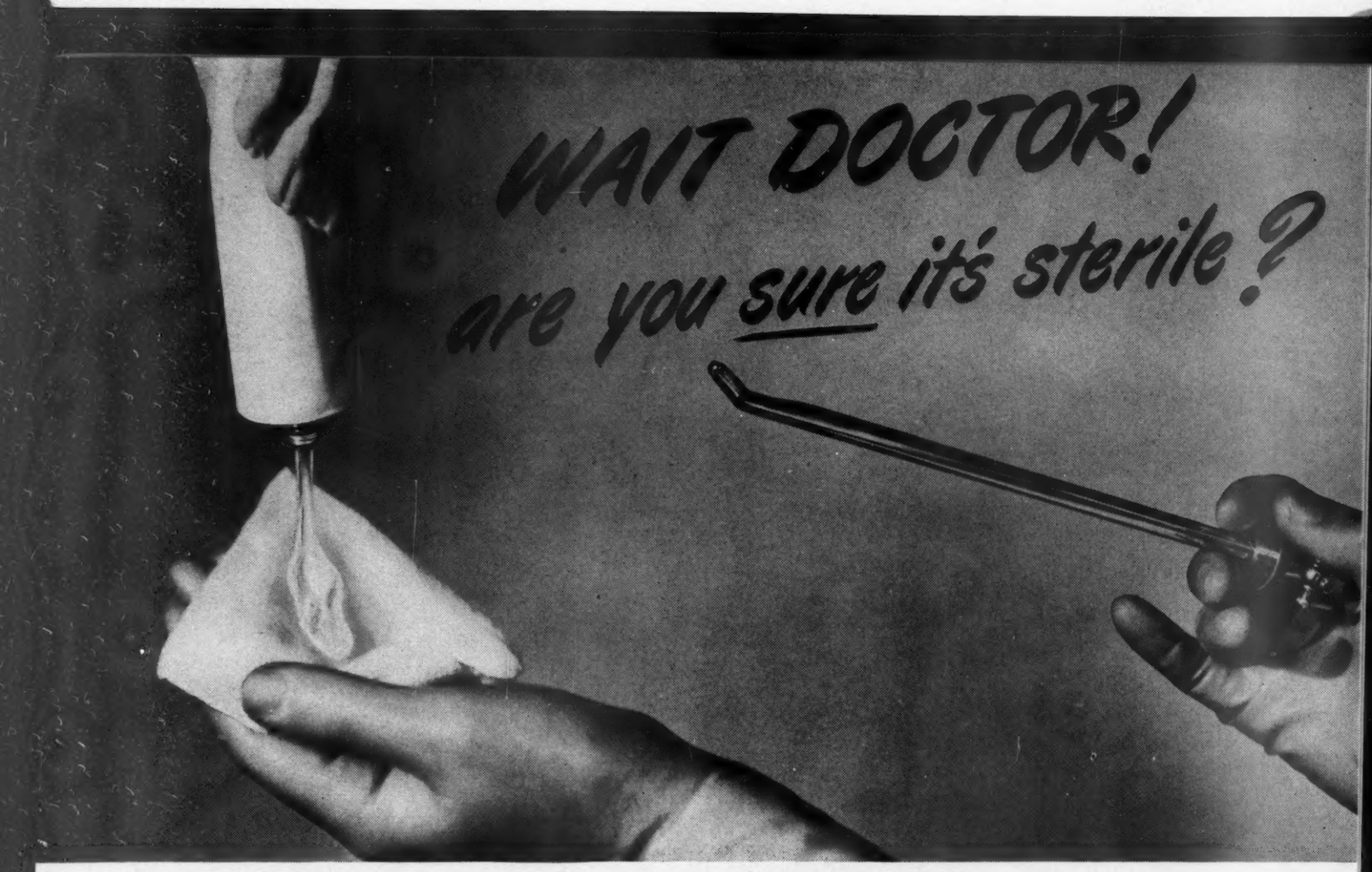

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VOL. LXXII OCTOBER, 1946 NUMBER FOUR

Editorial

THE FENESTRATION OPERATION

MAJOR HAZARD—THE ANESTHETIC

RECENT interest in the fenestration operation has focused attention upon an operative area of a few square millimeters. In an effort to provide ideal conditions for this field, methods of pain control are employed which constantly endanger the life of the patient. An attempt has been made to by-pass general anesthesia, a nuisance to be avoided, substituting for it analgesia and anesthesia by massive doses of barbiturates and opiates.

The novelty and the glamor of the new procedure seems to have deprived it of the wise and prudent approach common to anesthesia for the usual throat and ear surgery. Who, for example, would consider prescribing 9 gr. of barbiturates and ½ gr. of morphine for a radical mastoid operation? Who would tolerate, or be responsible for, postoperative respiratory depression lasting from eight to twenty-four hours for the ordinary nose and throat operation? As might have been anticipated, serious respiratory depression has already been reported.

The following notes are submitted from case reports: in Case 1, nembutal gr. 9, and morphine gr. ½ were administered and perfect analgesia was obtained for operation. During the night, however, respirations dropped to 2 per minute, requiring expert administration of oxygen, coramine and metrazol until recovery. In cases 2 and 3 both very large men, the first received 1 gr. of morphine before and during operation. He could scarcely be kept on the table. The second received 1⅛ gr. of morphine. Despite repeated novocaine injections he cried and fought constantly. The operation could scarcely be completed. Both patients exhibited respirations of six or seven a minute and required the constant attention of doctors and nurses for twelve hours. The patient in Case 4 was given nembutal gr. 9, neonal gr. 3, morphine gr. ⅔ and required stimulation for three days to overcome the depression which developed (first night respirations 4, second day 12, gradual recovery on third day). Case 5 illustrates the danger of intravenous pentothal. The patient received 2½ gm. of pentothol over a period of one hour and forty minutes and was unconscious for three days. The temperature rose to 104°F. postoperatively; the patient was restless and respirations were depressed until recovery. Case 6 indicates the handicap with endotracheal cyclopropane. Oozing was so general and so severe that only the mastoid operation could be done. The fenestration procedure

was done under a local anesthetic at a later date.

Why, it may be asked, has sedation been urged and general anesthesia avoided? Because general anesthesia means venous congestion and increased bleeding into a wound where hemostasis is essential? Because general anesthesia is thought to imply a prolonged and unpleasant postoperative period? Because general anesthesia, under good control and with the minimum after effects, implies expert service which is expensive and difficult to procure? It is not easy for one patient to pay for anesthesia for a whole morning or for an entire afternoon (two to three hours).

Because of these real difficulties, oral and hypodermic medication, supervised by anyone who happens to be available is a natural result. One attempt has been made to diminish the hazard of massive sedation. Demoral has been substituted for morphine. Experience will prove whether demoral can replace a general anesthetic for surgery involving the periosteum and provide a perfectly quiet field of operation.

Although fenestration surgery does not offer the anesthetic difficulties peculiar to abdominal, thoracic and brain surgery, it does most certainly line up to the general requirements of all general anesthesia. These requirements are: safety, control of the field and comfort for the patient.

The therapeutic index of sedative drugs prescribed by pharmacology, toxicology and clinical medicine must be respected. These indices cannot be cheerfully disregarded because a new type of operation holds the spotlight. The therapeutic index of nembutal (therapeutic breadth, or difference between anesthetic dose and lethal dose) is narrow, 1.5. Clinicians and anesthetists know that the routine use of even ¼ gr. of morphine sulfate occasionally results in grave respiratory depression. Massive sedation, by causing relaxation of the muscles of the airway, induces respiratory obstruction. This obstruction is increased by torsion and flexion of the head. Control of the respiratory airway is seriously embarrassed by the sterile head drapes covering the patient.

The surgeon, intent upon his field of operation, regards attempts to relieve obstruction as an unnecessary delay, an annoyance to be tolerated rather than cooperation for which to be grateful. As a consequence moderate obstruction is usually ignored, marked obstruction is permitted, and it is only when obstruction becomes acute that anything is done about it. If it were not for the reflex pain stimulating the respiration, asphyxial accidents would be common. Returned to bed, the patient's recovery from sedation is prolonged and is often the occasion of deep anxiety for the nursing personnel.

An experience of twenty years has convinced the author of the safety of the following sequence: Gas-oxygen Ether, precededed (recently) by nembutal gr. 1½, or avertin mg. 70, or demoral mg. 50. Following the relaxation under ether, direct laryngoscopy is performed and the patient is intubated. Anesthesia is maintained by ether at any desired level. Because of the bleeding which is prone to accompany gas-oxygen maintenance, and because of the fire, the bleeding and the circulatory hazard of cyclopropane, the author has eliminated these agents in his practice.

Once the patient is intubated, the respiratory hazard is by-passed completely and permanently. Anesthesia is easily controlled at any desired level with a low percentage of ether. The head may be flexed or rotated to any degree without influencing the freedom of respiration through the endotracheal tube. Intubation under ether relaxation by endotracheal tubes modified from Jackson's bronchoscope have produced no trauma and no bleeding, (hoarseness .05 per cent) in the author's hands.

In answer to queries concerning the postoperative symptoms which may be expected in ordinary laryngoscopy and intubation, the following is quoted from a letter received from the clinic of Dr.

Chevalier Jackson: "In reply to your letter of December 1st (1945) regarding reactions to bronchoscopy, neither Father nor I feel that there has been enough 'sore throat, hoarseness, tracheaitis, or bronchopneumonia' in the experience of our clinic, to merit even a mention. Of course, much depends upon the techniques used in these procedures, but we are firmly convinced that with reasonably careful technique and due consideration for the contraindications, bronchoscopy in itself is entirely without harmful effects." If to this experience of the Jackson Clinic is added the fact that laryngoscopy and intubation for anesthesia is a less severe procedure than bronchoscopy, and that it is carried on in a relaxed field, the hazard is acceptable.

By adhering to ether relaxation and the gentle introduction of sterile *metal* endotracheal tubes of the correct size, consistently satisfactory results may be anticipated. A properly relaxed patient will permit exposure and non-traumatic intubation, with one attempt, in less than a minute. For those who have never learned to give ether or who have forgotten how, intubation is frequently a hazardous adventure for patient and anesthetist. Deviations from the technic recommended, that is, exposure under various gas combinations, local pentothal, etc., by direct or blind intubation, is followed by frequent regrets.

Since analgesia and anesthesia by massive medication is irreversible (a dose once administered cannot be removed), the patient's response to pain is awaited as an indication for further dosage. This means that trouble always develops before it can be relieved. Moaning, straining, movement and holding the breath result in venous congestion and ooze, and the operating time is increased in an effort to control this ooze.

On the other hand, absolute and complete control is secured by endotracheal anesthesia. The field is silent and entirely motionless. Because there is no straining, and because respiratory ventilation is complete, venous stasis is eliminated. Bleeding in the field is arterial. This arterial bleeding will necessarily depend upon the normal blood supply to the part. While full sedation may be safely employed with the protection offered by endotracheal anesthesia, attempts to depress the general circulation by additional medication is certainly to be condemned. The patient's life is more important than an absolutely bloodless operative field. Furthermore, as in other types of head surgery, hemostasis may be aided by lowering the feet and the body, and by adrenalin packs allowed to remain for some minutes in the field.

The general anesthetic sequence recommended will not be as pleasant as in massive medication. Occasionally, a patient will complain of postoperative illness. The majority of cases of postoperative illness are due to anoxia rather than to the odor of the anesthetic; however, the patient as well as the surgeon, unfamiliar with endotracheal ether anesthesia, will be surprised by the rapid and smooth convalescence when a protracted postoperative illness was expected. Suitable preoperative medication allays apprehension and small doses of postoperative sedation provide comfort.

Therefore, the popularization of massive sedation as a substitute for general anesthesia in the fenestration operation endangers the life of the patient and prolongs the operative procedure. Bleeding in the field occurs from venous ooze and from arterial blood. Venous ooze is increased in respiratory obstruction and during spasm or straining from periosteal pain in which massive sedation is used. Sedation (barbiturates up to 9 gr. and morphine gr. ½) requires prolonged and careful postoperative nursing to prevent asphyxial accidents. Safety is assured and venous oozing is eliminated by a properly conducted general anesthesia with ether carried on by the endotracheal inhalation technic without carbon dioxide absorption. Well selected, small doses of preoperative and postoperative medication provide comfort for the patient. The employment of this technic will prevent asphyxial deaths.

Paluel J. Flagg, M.D.

Original Articles

IMPORTANCE OF SULFHYDRYL IN THE TREATMENT OF CORNEAL AND X-RAY BURNS

ARCHIE EDWARD CRUTHIRDS, M.D.
PHOENIX, ARIZONA

A SUBJECT of major concern to the ophthalmologist or surgeon is the after-scarring of burn patients. He is never permitted to lose sight of this possibility as evidenced by the patient's query: "Doctor, will it leave a scar?" Such anxiety on the part of parents reaches its peak when the patient is a child.

This question of scarring may not be confined to one of purely cosmetic considerations but, as every surgeon knows, may result in long and tedious plastic surgery at best, or at worst provide a field for malignant growth in occasional cases.

For this reason every method is sought to bring about healing of burns and wounds in the shortest possible space of time. Undelayed healing is a goal worth seeking for prevention of after-scarring as well as for other practical reasons.

Reference has been made to the fact that "Chronic granulation tissue is the parent of scar tissue, and it might be added the longer the wound takes to heal the more the scar tissue."[1]

A study based on five years of clinical application in more than 500 cases of burns, involving the eyes and adjacent areas provides a basis for hope that the danger of after-scarring may be greatly reduced. The therapy used in this study has produced healing without leaving scars or contractures in most cases. In the remainder any scarring was deemed to be considerably less than ordinarily might be expected. In no case was there evidence of development of symblepharon.

Available evidence points to the likelihood that this happy result is achieved by employing therapy that is capable of stimulating cell activity and producing healing in the shortest possible time. The clinical evidence appears to substantiate the biochemical aspects fully indicating that sulfur in an available form is capable of stimulating certain sulfur-containing amino acids present in the body and known to be concerned with tissue oxidations. In the study reported here the therapy used provided a high concentration of sulfhydryl* in an aqueous solution that is non-toxic and safe to use as drops directly in the eye in appropriate dilution, as well as orally and topically.

Adoption of a safe, non-toxic, available sulfur for the treatment of eye burns and possibly other eye conditions is indicated by extensive literature referring to the importance of sulfur-containing compounds in the eye. This is also true for other parts of the body.

X-RAY BURNS—CRITICAL TEST

The critical test for any treatment for burns might well be said to rest on the question: "How does it differ from any of the other 100 or more methods presently advocated?"

After five years of routine use combined with a search of the literature and an evaluation of clinical and laboratory studies by others, we are prepared to say that hydrosulphosol differs from other medications in

* Hydrosulphosol—a proprietary epithelial stimulant containing sulfhydryl pentathionate. The Am. Illus. Med. Dict., Dorland, 20th ed., Philadelphia, 1944. W. B. Saunders Company.

important and essential respects. Undoubtedly, an outstanding feature of this treatment is the fact that it has demonstrated in the hands of three different workers ability to stimulate tissue activity and bring about healing in *x*-ray burns. Here we are faced with a condition that has not merely resulted in a burn but an injury that leaves the underlying tissue devitalized.

In the presence of infection or poor physical condition of the patient, both of which retard or block healing of the wound, hydrosulphosol has elicited a long-sought chemotherapeutic response by promptly stimulating cell activity and bringing about healing in an incredibly short period of time.

Particular emphasis is placed, therefore, on one of the leading cases presented herein. This case involved a suspected malignancy complicated by a severe *x*-ray burn. (Fig. 1.) Radical surgery was avoided and recovery from *x*-ray burn effected in about three weeks. A brief case report is presented herewith on this patient.

Mrs. D. T., age forty-six, a married woman, had a past history of smallpox, typhoid, and influenza in 1918. Three years ago she had had her lower teeth extracted. The upper teeth were checked routinely. Her general condition was good with no headaches. Following a blow caused by being struck in the inner corner of the right eye by a door, an indurated skin lesion appeared just below and medial to the right orbit. Failing to effect healing by application of home remedies, the patient consulted her family doctor who diagnosed the condition as skin cancer and ordered *x*-ray treatment given. Twelve *x*-ray treatments were given by another doctor in the hospital.

X-ray treatments were followed by severe pain which gradually subsided after each treatment. After the twelfth treatment inflammation did not decrease. Radical surgery involving excision of affected tissue was considered when the patient was referred to me for consultation and treatment.

When first seen by me the area of scar from the *x*-ray treatments was broken down and practically devoid of blood vessels with an inflamed area extending along the right side of the nose to the right eye. This area was approximately 4 by 5 by 3 mm. just external to the right lacrimal sac area. The right eye watered continuously due to obstruction of the tear ducts by scar tissue. The area was quite painful to the patient. A smear and culture from this area showed presence of Staphylococcus albus infection. Kahn test and Wassermann reactions were negative.

Treatment was instituted with hydrosulphosol to attempt to clear up the *x*-ray burn. The patient was put on almost continuous application of warm hydrosulphosol packs both at the office and home. The pain and burning sensation cleared rapidly and after about six days scar tissue began to slough and there appeared to be a clean wound, the edges of which showed beginning of granulation tissue. At the end of ten days small islands of epithelium were present which spread gradually and the area was completely healed in about three weeks. The patient is seen occasionally and after eighteen months there has not been any breakdown or recurrence of original condition.

OLD *X*-RAY BURNS

The action of hydrosulphosol in a case of delayed *x*-ray burn, reported by MacDonald,[2] is suggestive of the wound healing possibilities of this product. In this case, widespread ulceration had finally supervened fifteen years after low voltage *x*-ray treatments and had led to the development of multiple telangiectoses, extending on both sides from Poupart's ligament to the heels. The biopsy showed the characteristic lesions of the *x*-ray both in the obliterative endarteritis in the floor of the ulcer and the precancerous changes in the epithelium.

The fact that the largest ulcer whose area was 48 sq. cm., continued to spread under a variety of accepted treatments whose duration covered more than a year, and, after three weeks of hydrosulphosol one-half of its area became covered with new epithelium and complete healing eventually took place, is exceedingly suggestive. In addition, the lesion was badly infected with Staphylococcus aureus and Bacillus pyocyaneus. Prior to use of hydrosulphosol amputation was being considered in this case.

Reinforcing these cases is the personal experience of Strong.[3] As one of the pioneers in development and use of *x*-ray, Dr. Strong sustained severe *x*-ray burns on the left hand, the result of cumulative exposures with development of a spreading epithelioma of the left wrist. After years of ineffectual treatment utilizing known methods calculated to assist repair of such lesions, Dr. Strong employed hydrosulphosol therapy immersing the hand in dilute soaks, applying it in wet compresses and finally as a lotion using full strength solution. Under the influence of hydrosulphosol therapy regenerative changes began and within six months the lesions entirely disappeared. Today, after more than five years there has not been any breakdown of tissue or evidence of any action other than establishment of complete healing.

One explanation of these remarkable results is suggested by the chemical composition of the product and its indicated relation as a nutritional factor in the skin itself.

SULFUR IN THE SKIN

Sixty per cent of the sulfur in the body is contained in the skin.[4,5] Harkins[6] recommends "sulfur to promote epithelization."

A sudden loss of sulfur in the skin and disturbance of sulfur metabolism caused by a serious or extensive burn has implications beyond that of a mere surface injury. As pointed out by Klauder and Brown,[7] "it appears that the skin acts as a depot of sulfur on which demands are made as part of the defensive mechanism operative in infections and intoxications." Thus it would appear that at one stroke the body can be rendered vulnerable in two important aspects by a burn injury. First, the skin and tissues suffer an injury to the chemical mechanism that is directly concerned with tissue respiration and repair. Secondly, important body functions that rely upon sulfur stored in the skin to supply a stimulus to organs concerned with detoxication and elimination of waste products, suddenly find the source of emergency supply temporarily exhausted. Every surgeon who has treated burns recognizes the dangers of infection, toxemia and other complications that can develop for a patient with an extensive or serious injury of this nature. Biochemistry recognizes and confirms the importance of sulfur in this situation. The problem has been to find a chemotherapeutic agent that measures up to the known requirements. Ten years of study and use of this product indicate that hydrosulphosol provides a practical as well as scientific approach to this problem.

An entirely new concept of the probable value of sulfur therapy in treating serious burns is suggested by Croft and Peters[8] who found that the sulfur-containing amino acid methionine, protects against decrease of protein by preventing or abating the depletion of nitrogen through the urine.

They state that similar losses in animals were noted in patients as long as ten days after the burn. Reference is made to the fact that the absorption of the free amino acids themselves is much more rapid than of the amino acids as gradually liberated in the gut by digestion from a protein. By way of further explanation these workers state: "One possible hypothesis to explain the benefit of increased protein intake is that the loss of N in the urine is due to the raiding of the tissue protein for one or two amino acids particularly needed for formation of new skin protein, and the elimination of the N from the unwanted amino acids of the tissue-protein molecule through the kidneys as urea. This led us to examine the effect of the sulfur-containing essential amino acid methionine, and also of an amino acid mixture, and of alanine and cysteine."

SULFUR IN THE EYE

The importance of maintaining or stimulating function and activity of glutathione, particularly in the lens of the eye, is suggested by the work of Mackay and coworkers[9] who report almost half of the total ash (45.8 per cent) of the normal lens consists of sulfate. A considerable portion of the sulfate recovered from the ash is

stated as probably arising from the combination of cysteine, glutathione, and other sulfur-containing organic compounds. Study of the mineral content of the eye shows that practically all of the minerals found elsewhere in the body are evident, but potassium and sulfur predominate.

Elvehjem and associates[10] in their classical work on respiratory enzymes emphasize the importance of the —SH groups (sulfhydryl) in glutathione with the observation that: " . . . it is the sulfur group alone which is of importance in connection with tissue oxidations."

Kogel[11] advances the suggestion that cataract patients be treated with sulfhydryl compounds because of their ability to transfer oxygen.

OXYGEN UPTAKE

The normal lens is capable of appreciable oxygen uptake and the importance of oxygen is pointed out by Bellows[12] who states: "The most vital requirement of any tissue is to secure at all times an adequate oxygen supply." In case of injury to the capsule there is a striking increase in respiration. Bellows also refers to the work of Mashimo[13] who reported that a normal rabbit lens requires 6 to 9 cu. mm. of oxygen per hour, whereas with a torn capsule the consumption more than triples (23 to 32 cu. mm. per hour). Similar findings were obtained by Schmerl.[14]

The vital rôle played by glutathione is pointed out by numerous workers who confirm the presence of this material in all fresh animal tissues in which the concentration roughly parallels the intensity of metabolic activity.

Reis[15] observed that sulfhydryl disappears in mature senile cataract. This was confirmed by Jess.[16]

Adams[17] and Rosner et al.[18] show that glutathione and a protein "thermostable residue" apparently contribute to the normal mechanism for most of the oxygen uptake of the lens.

Thus the employment of a safe therapy that is believed to be capable of increasing oxygen uptake and stimulating the activity of glutathione would appear to warrant use in treating burns and certain pathological conditions in which such therapy may be indicated.

HEAT DECREASES GLUTATHIONE

Adams[17] reports that the effect of heat produced a significant decrease of lenticular glutathione content.

While emphasis has been placed on the importance of glutathione in its respiratory function Krause[19] believes that protein synthesis may be dependent upon glutathione. This same opinion has been expressed by others.

Work by Bellows and Rosner[20] refers to the fact that "changes in the capsular permeability are intimately associated with the state of nutrition of the lens. A decreased permeability would offer a barrier to the normal interchange of nutrients and waste materials, which in turn could cause lenticular changes due either to deficiency of vital constituents or to an excess of a toxic compound. The reduction of glutathione in the cataractous lens is illustrative of this mechanism."

The detoxifying action of cysteine on naphthalene is pointed out by Bourne and Young.[21] "One of the Important Functions of glutathione is the protection of ascorbic acid against oxidation," according to Elvehjem et al.[10]

Thus we see in glutathione a material that plays an active and important rôle in maintaining the normal function of the lens of the eye and protecting it as far as possible against damage from injury or decreased body resistance. This same mechanism is referred to as of equal importance in other parts of the body.

It might well appear from a review of the literature that of all factors concerned with maintaining normal function of the lens of the eye sulfur may be the most important. Repeated reference to the rôle played by glutathione and sulfhydryl with an extensive bibliography on the subject is made in the very fine presentation by Bellows[12] in his book on "Cataract and Anomalies of the Lens."

In addition to the favorable outcome and prompt response to therapy noted in eye burns there has been an indicated value for employment of hydrosulphosol observed in the treatment of corneal ulcers.

Because of the difficulties presented in attempting an evaluation of a treatment on the basis of stimulating healing of injured tissue in man at a rate beyond what might be termed normal, a comparative analysis has been drawn between patients treated previously by other methods, also healing times reported by others when using other methods, and the actual healing time when using hydrosulphosol plus the previously mentioned lack of scarring. This comparison is deemed to be strikingly in favor of the sulfhydryl compound.

A natural and logical basis for consideration of a new medication or therapy is the constant search for methods of treatment that will be an improvement over others that are available or, when used with indicated medicants will speed recovery and improve end results. In the case of treating eye injuries, particularly burns, the local treatment applied to other parts of the body are seldom suitable to use in or near the eyes. The product used in this study proves an exception and certain experimental data compiled in connection with treatment of burns on the skin adds confirmation of important aspects considered in relation to treating eye burns.

The most common type of eye burn may cause searing only of the epithelium of the cornea. The normal healing rate in such cases might be regarded as rapid even when pain-relieving agents are all that are employed. But it is obvious that any treatment that will speed up healing time is deserving of consideration. In the cases of more severe burns in or about the eyes this factor becomes increasingly important.

The use of hydrosulphosol was started five years ago after investigation of the chemical composition of the product and of clinical and laboratory studies reported by workers at the Institute of Pathology, the Western Pennsylvania Hospital, Pittsburgh, at the University of California, Los Angeles, and others.

HIGH CONCENTRATION SULFHYDRYL

Salle reported[22] that hydrosulphosol contains a high concentration of sulfhydryl (approximately fifty times as much as in human blood). McBroom[23] reported encouraging results in a laboratory study using volunteers from the Research Institute Staff on whom experimental burns were produced by controlled exposure of small areas on the arms to ultraviolet radiation.

Pierce reported preliminary clinical studies[24] which were added to by a series of sixty-five cases, results of which are unpublished.[25] Mellon reported[26] on clinical and laboratory aspects relating to (1) lack of toxicity of hydrosulphosol when administered orally or applied topically, (2) indication of absorption of sulfur in some form and increased elimination of sulfate through the urine, (3) suggested possible enzymatic action of the —SH (sulfhydryl) linkages, (4) stimulation of certain host tissues by an increase in oxygen uptake, (5) more stimulation of cell function and the differentiation that connotes healing, than cell-multiplication only, (6) evidence based on tissue culture studies that not only does normal growth occur, but in dilutions of 1:500 to 1:1000 an important function of chick-heart embryo fibroblasts undergoes marked stimulation. "This function is the proteolytic one, whose differentiating, and therefore healing, connotations align themselves with the clinical expressions in this connection."

Striking response in the treatment of eye burns has been reported by this writer[27] also further studies in relation to the importance of sulfur metabolism and results obtained in treating burns of the ear, nose, mouth and adjacent tissues.[28]

The pH of hydrosulphosol, approximately 10, is lowered on dilution and rapidly reaches levels consonant with tissue function when applied to injured tissue. Confirmation of this action was reported by Williams and Bissell[29] who applied a 1:4

FIG. 1. FIG. 2. FIG. 3.

FIG. 1. Mrs. D. T., *x*-ray burn on right side of nose. Healing complete in three weeks without scars and without requiring surgical intervention.

FIG. 2. Face burn; gas oven explosion. Home remedies used for four days prior to consulting doctor. This picture taken start of hydrosulphosol therapy. No bandages applied; patient went about normal household duties.

FIG. 3. Same as Figure 2, ten days after start of hydrosulphosol therapy. No scars due to burns. Completely healed on tenth day with sulfhydryl treatment.

dilution with a pH of 9.5 to clean wounds on experimental animals and found a drop in three minutes to 7.9–8.1.

MULTIPLE CORNEAL ULCER

A second report in our series is presented herewith and relates to treatment of multiple corneal ulcer:

Miss J. L., age fourteen, came for treatment with severe pain in the left eye, stating that seventeen days before her eye became inflamed and painful. The patient was treated by a local doctor in town about 100 miles from Phoenix with several different types of medication without any improvements. Several days before being examined by me the patient stated that the whole cornea, with exception of small area in the upper central portion, became one mass of ulcers and vision was very poor. The patient's doctor telephoned me that it might be necessary to enucleate the left eye. The patient was first examined by me late in the evening of March 5, 1945. She was in extreme pain and it was necessary to administer a hypo to relieve pain.

Examination showed vision was limited to hand movement at three or four feet. Examination of the left eye showed extreme inflammation with ulcers occupying most of the central portion of the cornea and extending both nasally and laterally and to the lower portion of the cornea, but not involving the upper portion of the cornea. There was pus in the anterior chamber and there were some synechae present. Smear and culture showed pneumococal infection.

The patient was sent to the hospital and a sub-conjunctival injection of penicillin (250 units to the cc.) was given in the temporal nasal and lower bulbar conjunctiva using enough solution to bulge this membrane so that it was difficult for the lids to close. She was also given 30,000 units of penicillin intramuscularly with 20,000 units every four hours night and day until more than one million units had been given. Other treatment consisted of drops of hydrosulphosol (1:40) together with hydrosulphosol ointment at the corners of the lids which were quite inflamed. At the end of twenty-four hours her pain began to be much less and she was able to sleep without resort to opiates.

By the third day the pus in the anterior chamber was absorbed and the central portion of the cornea began to be more clear and the eye much less painful. The posterior synechae were broken up by atropine 2 per cent together with a sub-conjunctival injection of 1:1000 adrenalin.

At the end of two weeks the patient's eye was entirely free from pain and ulcers healed leaving, however, a large central corneal opacity which extended over the central and lower paracentral cornea. The patient was able to leave the hospital and come to the office for treatment where hydrosulphosol 1:20 was applied in compresses and 1:40 as drops in eye. Later on hydrosulphosol packs were used from time to time to aid in stimulating absorption of corneal scars.

The patient was sent home and returned from time to time for treatment and check-up. At the end of one year the patient was refracted and with proper correction was able to read 20/40 for distance and was able to read the Jaeger No. 2 line for near. The scar was practically invisible to anyone standing two feet away.

FAST HEALING

By way of illustrating the possible rapid response produced by prompt and intensive application of hydrosulphosol reference is made to a fifteen year old girl treated in our office. This girl received a direct blow in the eye from a hot curling iron. When first seen, approximately thirty minutes after the accident, the central part of the cornea was covered with a white exudate. The initial excruciating pain was controlled with anesthetics and irrigation of the eye started with drops of hydrosulphosol solution in a 1:40 dilution of warm triple distilled water. Instillation of these drops was repeated every half hour. In addition, a 1:20 dilution of hydrosulphosol in slightly warm distilled water was applied continuously in wet packs placed over the eyelids. This treatment was started at about 10:30 A.M. and by 4:00 P.M. of the same day the exudate covering the central cornea had entirely disappeared. At 5:00 P.M. examination of this area under slit lamp showed a practically clear cornea. Subsequent treatment

consisted of occasional instillation of dilute (1:40) hydrosulphosol drops.

NO BANDAGING REQUIRED

As many, if not the majority of, eye burns include some involvement of adjacent tissues; it may be well to note that the use of hydrosulphosol makes possible treatment of such burns without requiring bandaging of the head even in the case of face and scalp burns. This is of value both from the standpoint of morale of the patient as well as keeping the area open for inspection and treatment. The application of a 1:1 spray of hydrosulphosol solution on the face or burned areas about the face and head establishes quickly a dry, flexible coating. This coating has proven to be the only covering needed. The technic required for establishment of this protective coating is very simple. Sometimes a single application may be sufficient. Frequently additional applications may be advisable. It is important not to apply a heavier coating than is necessary to establish and maintain a dry, thin, flexible layer. But some additional applications may be advisable around the edges to prevent infection and speed healing.

Hydrosulphosol does not act as an escharotic but establishes a coating on an injured area such as a burn by depositing a thin layer of sulfur and calcium. Mellon reports[26] that on analysis a sample contained by weight, sulfur 8.3 per cent and calcium 5.7 per cent.

The indicated mode of action would be that the sulfhydryl or sulfur in some form is absorbed by the body during the process of establishing this coating. Tests by Pierce[25] indicate absorption of sulfur in burn cases treated by him with topical applications only. The medication will adhere to injured tissue but it is entirely safe to apply to the intact skin as well.

A case illustrated herewith with second degree burns of the face (Fig. 2), which also involved the eyes, is typical of the eye and face burns reported in this series. It is selected because of the fact that before hydrosulphosol therapy was applied the patient had attempted to treat the burn with home remedies for four days. When first seen by me there was swelling and indication of presence of infection. A 1:1 dilution of hydrosulphosol in distilled water was sprayed over the entire area. Hydrosulphosol ointment was applied around the corners of the mouth, nose and eyes. Before the picture in Figure 2 could be made, about four hours had elapsed after start of treatment. During that time the swelling was reduced and the patient was quickly in complete comfort. In fact she went home and resumed her normal household duties. She was seen by me daily thereafter. Additional dilute solution was applied as a spray at such points as were indicated, also ointment to areas where the spray would not adhere. Improvement was rapid and healing was complete without any scars within ten days after institution of this therapy. (Fig. 3.)

In a previous report[27] even faster healing of second degree burns on the face was noted. This patient was burned by live steam about the eyes, entire face, neck, chest, arms and abdomen. The application of hydrosulphosol spray 1:1 promptly relieved pain and produced complete healing of all burned areas within eight days without leaving any scars. This case was seen by me and treated within about thirty minutes after injury. This same material in ointment form was applied about the corners of the nose and mouth.

As hydrosulphosol is a chemotherapeutic agent, its maximum value as a healing agent is best realized by regular, repeated applications until all injured areas are healed.

It is important to maintain the coating as a thin pliable layer. A routine that has produced remarkable results in extensive third degree and old burns consists of the following: application of 1:1 spray to establish coating (one to four such sprays are generally ample and can be applied in thirty minutes or less with complete drying with the aid of a mild heat lamp). Then apply

four additional sprays at two-hour intervals. In the evening this coating or sufficient of it generally can be removed with a warm saline soak after which one or two applications of hydrosulphosol ointment can be made for the night treatment. In the morning remove ointment with cotton and repeat spray applications.

Repetition of this daily routine has demonstrated its value. The greatly decreased hospital time required for such patients meets effectively any objection to the slight additional medication, time and care required. The same routine is applicable also to burns of lesser severity in which even present short healing time can be reduced significantly.

PROMPT RELIEF FROM PAIN

It should be noted that although this medication does not contain any pain-allaying drug, it has the capacity to relieve pain promptly when applied to the skin and prevent recurrence of pain when used to treat burns of the eye or the skin. This capacity to relieve pain is attributable to laying down of a mechanical protection from air and a chemical union with oxygen.

When first instilled in the eye the dilute hydrosulphosol may cause a temporary stinging which wears off quickly. Even if the full strength solution should get in the eye there will be a stinging but there will not be any injury to the tissues. Reference to the use of hydrosulphosol for the treatment of eye burns is made by Kennedy[30] and Reeve.[31]

In the dilutions used in treating eyes the hydrosulphosol solution is prepared as follows: Drops directly in the eyes, 1:40 in warm triple distilled water at intervals of thirty minutes or up to two-hour intervals as extent of injury, progress of healing, etc., indicate.

Compresses on outside of closed lids, 1:20 in warm distilled water, applied continuously for several hours at start of treatment and then tapered off. The pH of these dilutions are as follows:

1:40 dilution	pH 8.2
1:20 dilution	pH 8.5

Because of its unique chemical composition the hydrosulphosol aqueous solution can be evaporated to constant weight to produce a concentrate which is combined with a suitable cold cream base to provide an ointment that has been used successfully, in conjunction with the solution, with satisfactory aid to healing processes in areas outside the eye where the use of an ointment would be indicated.

Another important feature of hydrosulphosol therapy observed in the series of cases reported herein was the absence of any clinical evidence of infection. This was in line with results previously reported by Pierce,[24] Mellon[26] and Cruthirds.[27,28]

It is well known to all who treat burns that more scarring is seen in infected burns than in non-infected ones. This is due of course to the time element. Infection prolongs healing time hence we must keep in mind one important burn treatment principle: the faster the healing, the less scarring.

CONCLUSIONS

From a review of the literature it would appear that the important rôle of sulfhydryl in tissue respiration and repair is well established by scientific research. Very little reference, however, is made to the availability or use of medicants suitable for combatting dangerous deficiencies of this sulfur constituent which is present ". . . in all protoplasm with an active metabolism," according to Klauder and Brown.[7]

All of the work done to date on hydrosulphosol suggests a definite value for the critical proportions of its sulfur-bearing compounds, present in aqueous solution, particularly the —SH groups or sulfhydryl linkages. Certainly in our work we have not encountered another agent that has brought about healing of devitalized tissue as in an *x*-ray burn, as has been demonstrated by hydrosulphosol.

In connection with this product two additional factors appear to have been important in connection with its use over a period of five years: (1) The comparative economy with which it can be used, and (2) the decrease in nursing and hospital care.

It is believed fair to state that, as compared to other methods, the time required to effect healing of burns can be reduced from one-third to one-half or more when employing this sulfhydryl therapy. When instilled as drops in the eyes, the dilution used represents a cost of medication that can be measured in fractions of a cent. No emphasis is needed to point out the value of time that might be saved to workers and employment of a regimen that is marked with comfort for the patient and likelihood of recovery without after-scarring or contractures.

While additional study is needed to confirm various aspects related to the utilization of a product of this nature by the body in the synthesis of sulfur-containing amino acids, scientists acquainted with the chemical composition of hydrosulphosol are inclined to the opinion that it is capable of acting in this manner. Certainly clinical observations strongly suggest a mode of action that favorably influences processes concerned with tissue respiration and repair, in which functions sulfur-containing amino acids are known to play important rôles. How far this may go in favorably influencing or stimulating organs concerned with disposal of toxins and waste products, the transport of oxygen and other vital factors that may turn the tide toward recovery in serious or extensive burns, is deemed worthy of investigation and study.

SUMMARY

1. A sulfhydryl therapy has been employed in treating a series of more than 500 burns involving injury to the eyes and adjacent areas over a period of five years.

2. Results observed indicate advantages over other methods expressed in (1) ability to heal *x*-ray burns in which tissue was devitalized or ulcerated condition and infection were present, (2) healing with less chance of development of symblepharon, (3) faster healing, (4) lack of scarring, and (5) absence of infection.

3. The product used, hydrosulphosol, presents sulfur in a "free" colloidal state with a high concentration of sulfhydryl suggesting availability of sulfur in a form that can be utilized by the body in the synthesis of sulfur-containing amino acids.

4. A review of the literature reveals the importance of sulfur-containing compounds in the eye which compounds have been shown to constitute almost one-half of the mineral content of the lens, and are connected with such functions as tissue respiration, oxygen transport, detoxication, capsular permeability, protein synthesis and general metabolic efficiency. The importance of these compounds is referred to in other organs of the body—the liver, kidneys, spleen, etc.

5. In addition to its use as a treatment for burns, this product has been used in conjunction with penicillin in the treatment of multiple corneal ulcers with results not heretofore observed when using penicillin alone.

6. No contraindications have been observed for this product when used with other medicants. Also, there has been no evidence of any toxic reaction following free and repeated application and use of this sulfhydryl-bearing solution.

REFERENCES

1. Treves, N. and Pack, S. T. The development of cancer in burn scars. *Surg., Gynec. & Obst.*, 51: 749–782, 1930.
2. Macdonald, Ian. Personal communication.
3. Strong, F. F. Personal communication.
4. Aldrich, R. H. The story of burns. *Massachusetts Gen. Hosp. Bull., Boston, Mass.*, 1941.
5. Cogswell, H. D. and Shirley, Clayton. The treatment of burns. *Am. J. Surg.*, pp. 539–545, Sept., 1939.
6. Harkins, H. N. Treatment of burns, general care of the burned patient. Prepared for Special Exhibit on Burns, Scientific Exhibit, A.M.A., Chicago Session, 1944.
7. Klauder, Joseph V. and Brown, Herman. Certain phases of sulfur metabolism of the skin. *Arch. Dermat. & Syph.*, 34: 568, 1936.
8. Croft, P. B. and Peters, R. A. Nitrogen loss after thermal burns. Effects of adding protein and

methionine to diet of rats. *Lancet*, p. 266, Mar. 3, 1945.

9. Mackay, G., Stewart, C. P. and Robertson, J. D. A note on the inorganic constituents of normal and cataractous human crystalline lenses. *Brit. J. Opbtb.*, 16: 193–201, 1932.
10. Elvehjem, C. A. and Wilson, P. W. Respiratory Enzymes. Minneapolis, Minn., 1939. Burgess Publishing Company.
11. Kogel, G. Die Starbildung und die photo-chemischen Wirkungen der Sulfhydril-systeme. *Arcb. f. Opbtb.*, 126: 502–503, 1931.
12. Bellows, John G. Cataract and Anomalies of the Lens. P 212. St. Louis, 1944. C. V. Mosby Company.
13. Mashimo, M. Ueber der Gasmechsel der Linse. *Klin. Wchnschr.*, 2: 1809, 1923.
14. Schmerl, E. Zum Gaswechsel der Linse. *Arcb. f. Opbtb.*, 119: 130–134, 1927–1929.
15. Reis, W. Ueber die Cysteinreaktion der normalen und pathologische veranderten Linsen. *Arcb. f. Opbtb.*, 80: 588–598, 1912b.
16. Jess, A. Zur Chemie der Cataracta senilis. *Arcb. f. Augenb.*, 71: 259–266, 1912.
17. Adams, D. R. Investigation on the crystalline lens. *Proc. Roy. Soc., London*, 98: 244–259, 1925.
18. Rosner, L., Farmer, C. J. and Bellows, J. G. Biochemistry of the lens: studies on glutathione in crystalline lens. *Arcb. Opbtb.*, 20: 417–426, 1938.
19. Krause, A. C. The Biochemistry of the Eye. Baltimore, 1934. Johns Hopkins.
20. Bellows, J. G. and Rosner, L. Biochemistry of the lens. xi. Effect of galactose on permeability of the capsule of the lens. *Arcb. Opbtb.*, 20: 80–84, 1938.
21. Bourne, M. C. and Young, Leslie. The metabolism of naphthalene in rabbits. *Biocbem. J.*, 28: 803–808, 1934.
22. Salle, A. J. and Korzenovsky, M. Nature of hydrosulphosol and its toxicity to living embryonic tissue. *Proc. Soc. Exper. Biol. & Med.*, 49: 212–215, 1942.
23. McBroom, J. The use of sulfhydryl solutions in burns caused by ultraviolet radiation. *Med. Rec.*, 152: 299, 1940.
24. Pierce, W. F.: The Use of a Sulfhydryl Solution in the Treatment of Burns. *Am. J. Surg.*, 53: 434–439, Sept., 1941.
25. Pierce, W. F. Personal communication.
26. Mellon, R. R. A new sulfhydryl solution for the treatment of burns. *Indust. Med.*, Jan., 1942.
27. Cruthirds, A. E. The treatment of face and eye burns with a sulfhydryl solution. *Indust. Med.*, March, 1942.
28. Cruthirds, A. E. Burns of the ear, nose, mouth and adjacent tissues. *Laryngoscope*, July, 1943.
29. Williams, Robert H. and Bissell, Grosvenor W. Effects of topical application of vitamins and some other chemicals on the healing of wounds. *Arcb. Surg.*, 49: 225–227, 1944.
30. Kennedy, Foster. Brain injury in war. *Am. J. Surg.*, 56: 343–345, 1942.
31. Reeve, Bryce B. Management of burns. *Illinois M. J.*, 83: Jan., 1943.

TOTAL EXCISION OF THE PATELLA FOR FRACTURE*

REPORT OF FOURTEEN CASES

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INTEREST in the treatment of fractures of the patella by total excision was stimulated by the strikingly good results reported by Brooke[1,2] in 1937. Patellectomy was not a new method of treatment; it has been occasionally practised from 1860 in treating lesions of the patella other than fractures, and it had been used in isolated cases of fractures from 1890. Despite the enthusiastic endorsement of the method following Brooke's report, particularly in England, and despite the many publications that have appeared on excision of the patella, the cases reported have actually been few in number. Indications for patellectomy in the treatment of fractures are still not well defined. The following report covers a series of fourteen cases in which patellectomy was considered to be indicated, and in eleven of which observations after an adequate lapse of time permitted evaluation of the method.

The excision method was the outgrowth of the attempt to find a more promising procedure than operative suture of the patella. The latter method, which is still the orthodox form of treatment, is followed by prolonged disability. The knee must be immobilized for from four to six weeks to ensure union. Then follows a long period of incapacity while union becomes firm and the quadriceps regains power. At best, work of a strenuous nature can seldom be resumed in less than six months.

The results of the open suture method in comminuted fractures are far from satisfactory. In a study of fifteen comminuted fractures that had been treated by suture methods in our clinic, only two good functional results were observed. As a rule, the patella in healing becomes exceedingly hypertrophied, spreading out over the femoral condyles like a pie plate. The function is limited, and the flexion movement seldom passes beyond the right angle. In time the irregularities of the patellar surface lead to the development of arthritic changes.

Some operators claim that the results of operative suture of transverse fractures likewise are unsatisfactory, and that the method should be discarded in favor of patellectomy. Brooke[2,3] is a staunch advocate of its use in transverse fractures. Among the objections raised to operative suture of this type of fracture is the danger of refracture because of the fibrous union that takes place. It is also claimed that complete function is never regained, and that the knee remains weak, leaving a person handicapped in climbing stairs. Moreover, if it is not possible to secure exact alignment of the fragments, there is the likelihood that the friction between the roughened patellar joint surface and the condyles will lead to the development of arthritic changes.

At the present time, surgeons are not quite ready to accept patellectomy as the routine treatment for transverse fractures, even though it is acknowledged that the method has given excellent results. A surgeon is reluctant to sacrifice the patella when the fracture is a fresh and simple break in a young or middle aged adult, because its removal presents certain possible drawbacks. Moreover, it must be admitted that the results of suture fixation of the fragments and lateral aponeurosis in transverse fractures are, on the whole,

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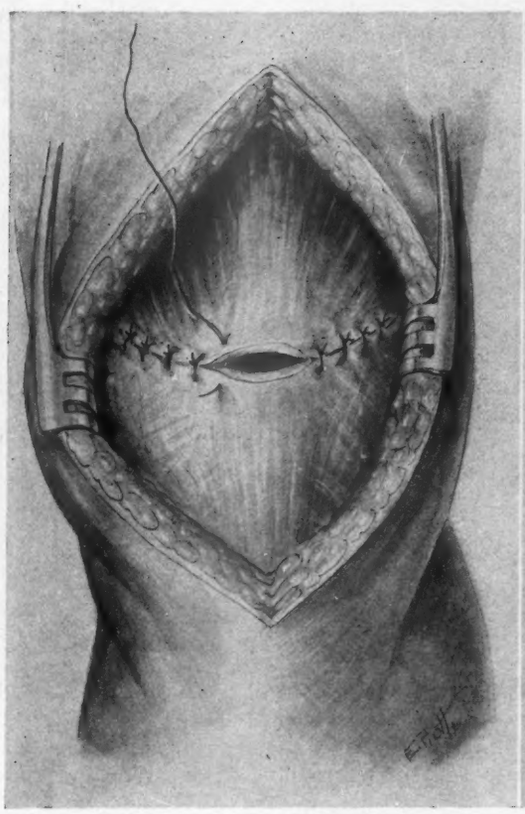


Fig. 1. Closure of the tendon and lateral aponeurosis with interrupted chromic catgut sutures.

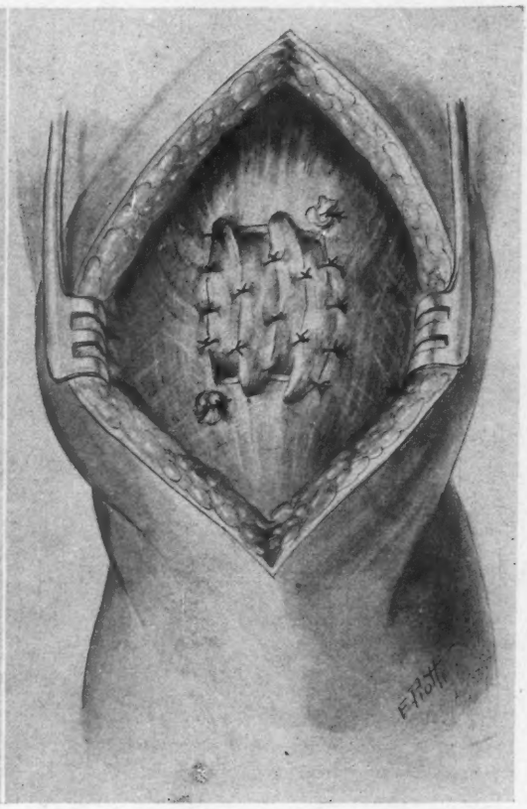


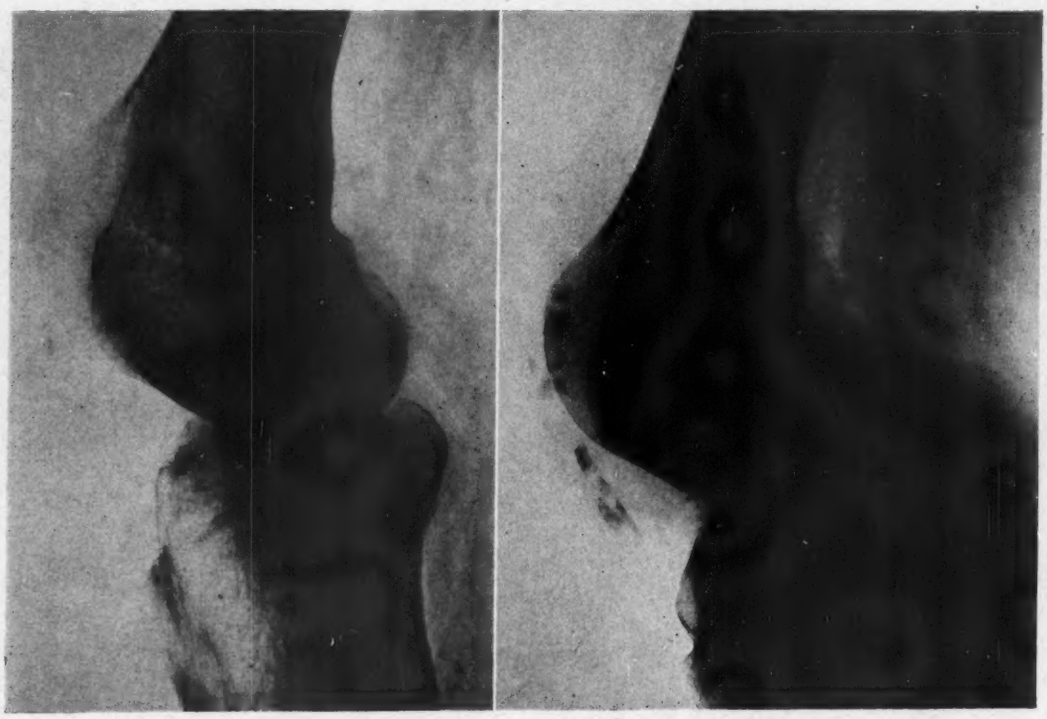
Fig. 2. Closure of a wide gap between the tendon edges by means of strips of fascia lata.

satisfactory. The prolonged convalescence, which is the great objection to the method, may be shortened materially by using screw fixation, which permits motion to be started in ten days, in contrast with the four or six weeks' delay when suture fixation is used.

Among the drawbacks to the removal of the patella is the appearance of the knee, particularly if the patient is a woman. Then, too, the patella undoubtedly protects the knee joint from direct injury in flexion positions.

The possibility of the development of arthritic changes as the result of the quadriceps passing directly over the condylar surfaces, in the absence of the patella, is another objection that may be raised. Bruce and Walmsley[4] and Cohn,[5] in experimental observations, noted degenerative changes in the articular cartilage of the joint following the removal of the patella. Whether similar changes will appear in the knee of the human joint remains to be determined. Brooke[3] observed no arthritic changes in a roentgenographic examination of twenty-nine cases in which the patella had been excised from five to fifteen years previously. In the series of cases herein reported, no degenerative changes were observed in a late roentgenographic examination of the knees of three patients, aged thirty-five, fifty-six and seventy years, respectively.

The question also arises as to whether the patella plays a rôle in the function of the knee by adding to the extension movement through a pulley effect, whereby the quadriceps is raised up from the condyles. There is no unanimity of opinion on the function of the patella. Brooke[2] believes that the patella contributes nothing to the function of the knee; rather, it is his opinion that the patella acts as a deterrent to function. Brooke's[1,2,3] suc-



A B

FIG. 3. A, roentgenogram taken three months after patellectomy, showing islands of ossification; B, roentgenogram of the same knee taken one year after patellectomy, showing increased density of ossified areas.

cessful results would certainly substantiate his opinion. Haxton[6] has discussed in detail the rôle of the patella in the knee mechanism. In Haxton's experimental and anatomical study, as well as in the experimental observations of Carey, Zeit, and McGrath[7] and Bruce and Walmsley,[4] the patella was found to have an important functional value. Other observers in their clinical experience have noted a slight loss of the extension power and buckling of the joint following patellectomy.[8,9,10] In the series of cases being reported, a slight laxity was noted in four cases.

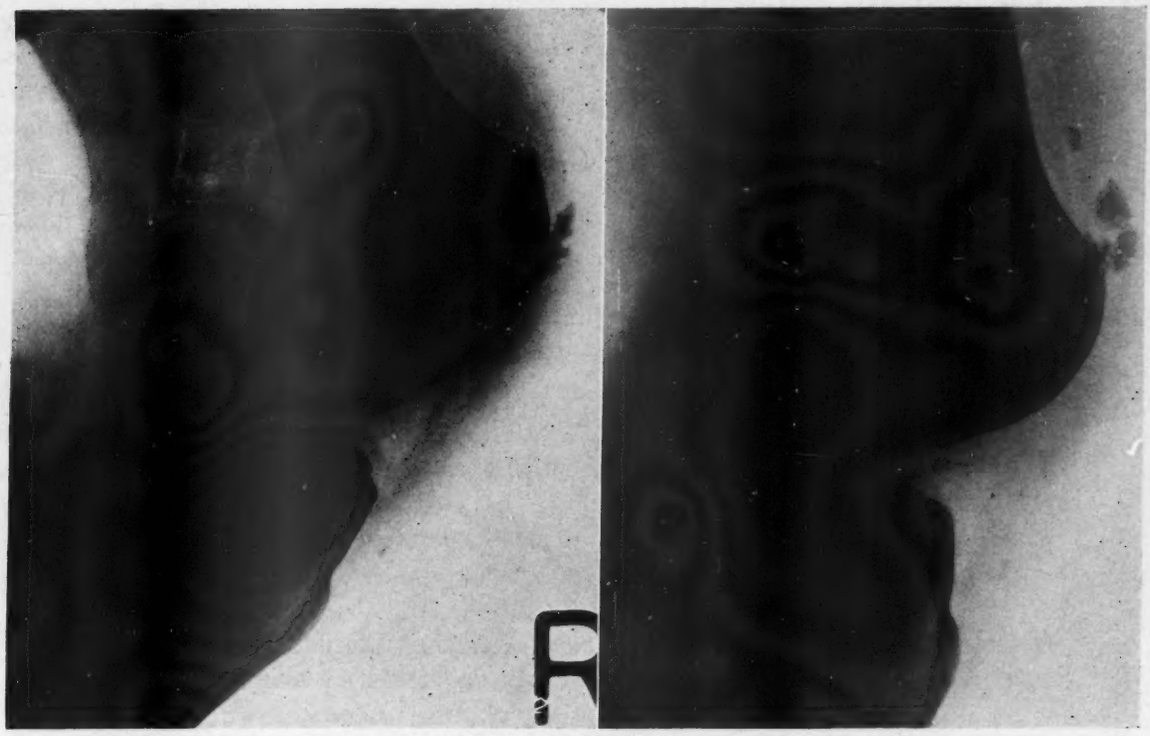
Whether all of these objections to patellectomy may be obviated by regenerated areas of bone at the former site of the patella remains to be determined. The subject of regeneration is discussed further on in the paper.

At the present time when so many factors are in doubt, indications for patellectomy are, for the most part, limited to certain types of fracture. In severely comminuted fractures, whether recent or of long standing, excision offers the only solution to the difficult problem of treatment. Excellent functional results are obtained in contrast with the uncertain results from the suture method of treatment. The convalescence is rapid, and hospitalization is usually necessary for only two weeks.

Excision of the patella is indicated in cases of malunion or non-union in transverse fractures that have been unsuccessfully treated by other methods. In such fractures, good function is recovered following patellectomy, and the development of arthritic changes from the irregular patellar surface is checked.

OPERATIVE TECHNIC

When the patient's condition permits, operative excision of the patella is carried out in forty-eight hours after the injury. (Figs. 1 and 2.) In view of the early development of atrophy of the quadriceps following a fracture of the patella, it is advisable not to delay the operation for more than five days. During the period of waiting, the knee is kept tightly bandaged



A B

FIG. 4. A, roentgenogram taken three years after patellectomy, showing islands of bone; B, roentgenogram of the same knee taken six years after patellectomy, showing increase in bony areas.

to prevent swelling, and it is splinted in the position of extension and elevated.

A longitudinal incision, extending from the region of the lower quadriceps tendon down to about 1 inch along the patellar tendon, and just a shade lateral to the midline, is made through the skin. If preferred, a U-shaped or a transverse incision may be used. Dissection is carried out, exposing the fracture cavity, the capsular tears and the traumatized quadriceps expansions. Blood clots are cleaned out of the joint. The patellar fragments are easily shelled out from the quadriceps tendon, care being taken to keep close to the anterior and lateral surfaces of the fragments in order to avoid sacrificing any of the tendon.

The frayed edges of the extensor tendon and its medial and lateral expansions are trimmed. The freshened edges are then approximated, if possible, the quadriceps tendon being forced down to the patellar tendon. It is well to suture the aponeurosis first, as by so doing the main part of the tendon can be sutured more easily. The ends of the tendon proper are united with interrupted chromic catgut sutures. When the ends of the tendon cannot be approximated because of contracture, strips of fascia lata taken from the thigh may be used as a running suture to close the gap.

The skin is closed with interrupted sutures of silk. A compression dressing, a snug flannel bandage and a ham splint are applied. Penicillin is given for two or three days.

Postoperative Care. Most important in the postoperative treatment is the prevention of weakness of the quadriceps muscle by early mobilization. Just when contraction exercises may begin will depend upon the extent of the damage in the soft tissues as well as upon the postoperative reaction. In the average case, contraction exercises may be started at the end of the first postoperative week, and by the tenth day the patient can carry them out well.

The splint is removed on the tenth day, and the patient begins to flex the knee gently by swinging the leg over the

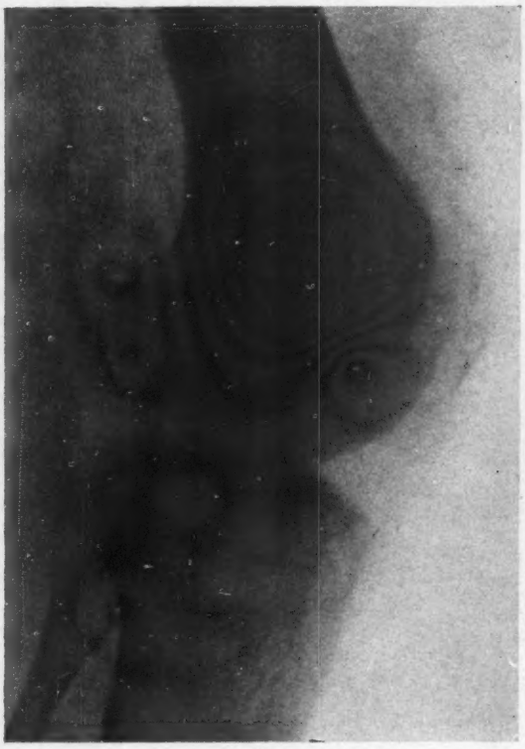


FIG. 5. Roentgenogram showing large osseous flakes at the sixth postoperative month.

edge of the bed. Care is taken always to keep the motion within the limits of pain. Hot fomentations are applied for twenty minutes, three times a day. After the tenth day the patient may walk with the aid of crutches.

At the end of the second postoperative week, the patient is discharged from the hospital, and given instructions to continue exercising and using the leg. Swimming, or exercising the leg in a tub of hot water, twice a day, is recommended. Within from two to three weeks, motion to the right angle is usually established. By the third week, the patient is bearing weight and walking without the aid of crutches.

In the average case the quadriceps is strong and well controlled in from six to eight weeks. The knee functions well and is stable. The patient can walk normally and go up and down stairs. The rate of recovery depends to a great extent upon the cooperation of the patient.

Just when the patient may resume work depends upon the nature of his occupation. A person who has a sedentary position may return to work in from four to six weeks after the operation. A laboring man is ready to resume light work in from six to eight weeks. Return to strenuous work is possible within three or four months following the operation. No heavy work should be undertaken until the tissues are well healed and until the quadriceps, which exerts excessive tension, is strong.

REGENERATION OF THE PATELLA

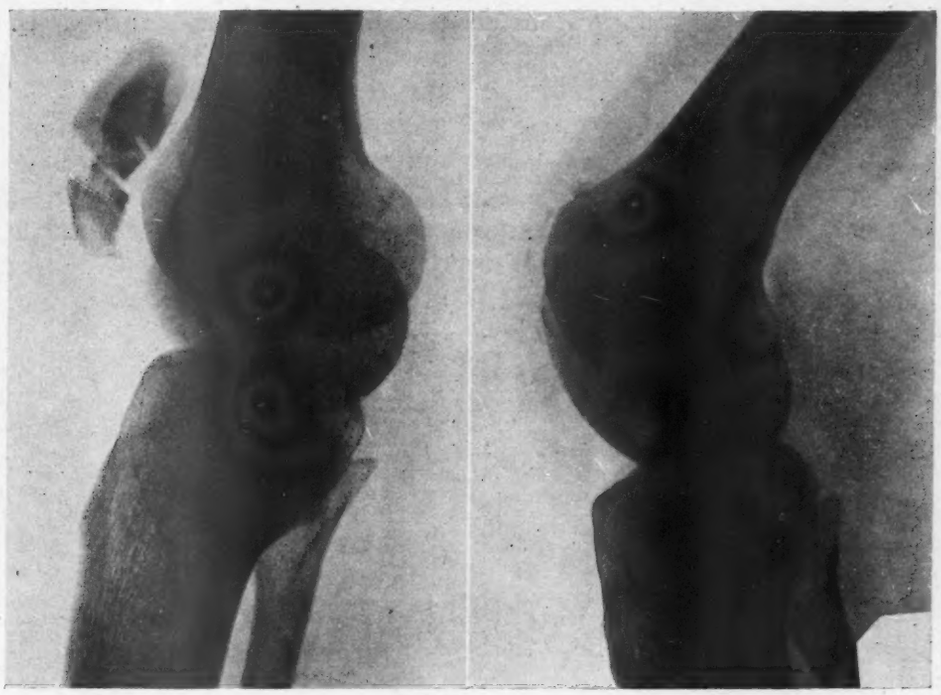
In experimental studies by Carey, Zeit, and McGrath[7] and Bruce and Walmsley,[4] calcified areas have been found to replace the excised patella. Similar foci have been noted following the removal of the patella in humans by Dobbie and Ryerson,[11] Albert,[12] Wass,[13] Mehriz,[14] Murphy[15] and Schmier.[16]

Whether actual regeneration of the patella takes place in response to a mechanical need, or whether the areas of calcification develop from remaining osteoblasts is still in question. Certainly islands of density are seen in roentgenograms following excision of the patella. In a study of the late roentgenograms in eleven of the cases being reported, islands of calcification were noted in all except two cases. In one case the foci were present at the third postoperative month, and one year later showed considerable increase in density. (Fig. 3.) A similar increase in density was seen in the roentgenograms of another case that were taken during the third and sixth postoperative years. (Fig. 4.) A roentgenogram of one other case showed large osseous flakes at the sixth postoperative month. (Fig. 5.)

ANALYSIS OF CASES

The series includes fourteen cases of fractures of the patella that were treated by total excision of the bone. Nine of the patients were males. In age the patients ranged from twenty-nine to seventy-seven years. The fracture is most common at middle age.

Twelve fresh fractures were of the comminuted type, the patella being shattered throughout in six cases, broken into three pieces in two cases, the lower



A B

FIG. 6. A, comminuted fracture of the patella; B, roentgenogram taken two years after patellectomy.

half alone being comminuted in three cases, and the upper half in one case. One case was a comminuted fracture of long standing in which the patella was extremely broadened. The remaining case was a transverse fracture of long standing, which had been treated unsatisfactorily by other methods. One fracture only was compound.

Eight of the twelve fresh comminuted fractures were associated with other injuries. In two cases there were lacerations of the knee; in two cases, abdominal injuries; in one case, there was a Monteggia's fracture; in one case, a compound comminuted fracture of the lower third of the femur on the same side as the patellar fracture; in one case, a fracture of the elbow; and in the eighth case, the rectus femoris muscle was partly severed. The period of hospitalization in all except one of these cases was prolonged because of the concomitant injuries, and the final result in the case of the associated fracture of the femur was complicated by that injury.

Six of the twelve fresh fractures were operated upon within four days of the injury. In the other six cases, operative interference was delayed from one week to seventeen days because of associated injuries.

The period of hospitalization in three of the twelve cases of fresh comminuted fractures and in the two cases of long standing averaged two weeks. In one uncomplicated case, the patient was kept in the hospital for twenty-four days because of his advanced age. In the remaining eight cases, the postoperative hospitalization was delayed because of associated injuries.

Results. In eleven of the fourteen cases in this series, sufficient time has elapsed to permit judging the late results. (Fig. 6.) The postoperative check in two cases was made more than six years after the removal of the patella; in four cases within two to four years; in another four cases in one year after the operation; and in one case after a period of eight months. The patellectomy in the remaining three patients was carried out too recently to permit judging the end results, but the progress made in recovery has been very rapid and favorable.

Ten of the eleven patients obtained good functional knees with perfectly free joint motion and stability. In five of the cases, every test of power and motion could be met. The patients could hold the leg out straight in full extension; they could squat fully and with ease on the operated leg; they could go up and down stairs normally; and they could walk long distances with comfort. It was impossible to detect any difference between the function and stability on the operated side and on the uninjured leg. Four of these patients had returned to their respective occupations, one as a freight handler, another as a railroad laborer, the third as a housewife, and the fourth as a chicken farmer, in from three to four months after the operation. The other patient had no occupation.

In four cases, the quadriceps was not so strong as in the normal knee, and there was a laxity of about 10 degrees that prevented complete extension. Notwithstanding, the quadriceps still had good power, the flexion movement was normal, and the patients reported no disturbance of function. The only complaint was that the knee buckled occasionally. Three of these patients did arduous work, two of them in a mill and one in a foundry.

The tenth patient, aged seventy-seven years, had complete motion of the knee in both extension and flexion when she was examined in one year. However, she had to go down stairs a step at a time.

In the eleventh case, the outcome was poor. Flexion of the knee was possible to only the right angle. There was a tender area over the bridge between the patellar and quadriceps tendons, indicative of weakness.

SUMMARY

A report has been presented on the treatment of fourteen fractures of the patella by total excision of the bone. In eleven of the cases, sufficient time had elapsed to judge the end results. Ten of these patients obtained good functional knees. The convalescence was rapid, and the patients had returned to work in much shorter time than is possible under suture fixation methods.

The procedure is considered to be indicated only in certain fractures. It offers a solution of treatment in severely comminuted fractures, whether recent or of long standing, in which under the orthodox suture methods, the period of disability is prolonged and the results are unsatisfactory. Patellectomy is also indicated in transverse fractures of long standing in which malunion or non-union has resulted. The method is not recognized as the established treatment of fresh transverse fractures.

REFERENCES

1. Brooke, R. Effect of removal of patella for simple transverse fractures on function of knee joint. *Proc. Roy. Soc. Med. (Orthop. Sect.)* 30: 203–207, 1937.
2. Brooke, R. Treatment of fractured patella by excision. Study of morphology and function. *Brit. J. Surg.*, 24: 733–747, 1937.
3. Brooke, R. Fractured patella. An analysis of 54 cases treated by excision. *Brit. M. J.*, 1: 231–233, 1946.
4. Bruce, J. and Walmsley, R. Excision of patella; some experimental and anatomical observations. *J. Bone & Joint Surg.*, 24: 311–325, 1942.
5. Cohn, B. N. E. Total and partial patellectomy: experimental study. *Surg., Gynec. & Obst.*, 79: 526–536, 1944.
6. Haxton, H. A. Function of patella and effects of its excision. *Surg., Gynec. & Obst.*, 80: 389–395, 1945.
7. Carey, E. J., Zeit, W. and McGrath, B. F. Studies in the dynamics of histogenesis. *Am. J. Anat.*, 40: 127–158, 1928.
8. Heineck, A. P. Fractures of patella: 1 100 cases treated by open method. *Surg., Gynec. & Obst.*, 9: 177–248, 1909.
9. Wass, S. H. and Davies, E. R. Excision of patella for fracture with remarks on ossification in quadriceps tendon following operation. *Guy's Hosp. Rep.*, 91: 35–57, 1942.
10. Loomis, L. K. Fractures of patella-analysis of 150 cases at Charity Hospital. *New Orleans M. & S. J.*, 97: 173–176, 1944.
11. Dobbie, R. P. and Ryerson, S. Treatment of fractured patella by excision. *Am. J. Surg.*, 55: 339–373, 1942.
12. Albert, S. M. Excision of the patella. *J. Iowa M. Soc.*, 33: 184–187, 1943.
13. Wass, S. H. Treatment of fractures of patella. *M. Press*, 210: 87–90, 1943.
14. Mehriz, M. M. Simple fracture of patella treated by removal of fragments. *Lancet*, 1: 91, 1939.
15. Murphy, J. J. Bilateral fracture of patella. *Brit. M. J.*, 1: 725, 1943.
16. Schmier, A. A. Excision of the fractured patella. *Surg., Gynec. & Obst.*, 81: 370–378, 1945.

ANORECTAL ABSCESSES*

DISCUSSION AND TREATMENT

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THE purport of this discussion is three-fold: (1) the localization of abscesses in the anorectal spaces; (2) the spread of infection along the fascial planes of the perineum to definite areas, namely, the perinephreum, pelvic cavity, thigh, scrotum or labia, along the spermatic cord and the abdominal wall, and (3) the surgical approach necessary to stop the spread of infection and to prevent fistula formation.

The anorectal spaces are classified according to their location above or below the levator ani muscles:[2] *I. Supralevator spaces:* (1) pelvirectal; under the peritoneum between the lateral wall of the rectum and superior surface of the levator ani muscle; (2) retrorectal; under the peritoneum, between the rectum and sacrum, bounded laterally by the lateral ligaments of the rectum; (3) intramural (submucous); under the mucosa of the rectal wall. *II. Infralevator spaces:* (1) marginal, between the external sphincter and the lining of the anal canal; (2) perianal, between the external sphincter and skin; separated from the ischiorectal space by the tela subcutanea; (3) ischiorectal, bilateral, beneath the levator ani muscle. This space is potentially connected with the space on the opposite side both anterior and posterior to the anus. The levator ani with its enveloping fascia forms the main portion of the pelvic diaphragm and blends anteriorly with the urogenital diaphragm giving an anterior projection to the space. Colles fascia coming from the scrotum and uniting with the posterior edge of the urogenital diaphragm separates the ischiorectal space on each side from the corresponding superficial perineal space which is an approach to the suprapubic area. The obturator internus muscle at the lateral border of the ischiorectal space guards the obturator foramen leading to the thigh. The tela subcutanea separates the ischiorectal space from the perineal space and from the skin. Laterally the tela subcutanea blends with the gluteus maximus muscle and medially with the external sphincter.[16] Figure 1 illustrates the anorectal spaces.

Anorectal infections begin at one of four sites: (1) Anorectal lining; (2) the perianal skin; (3) deep glands connected with the urogenital tract;[1,15] and (4) coccyx and sacrum.[6]

Anorectal Abscesses Beginning at the Lining of the Anus and Rectum. This approach accounts for a predominant number of anorectal abscesses. The mucosa of the rectum covers the hemorrhoidal venous plexuses to the crypts of Morgagni where it changes to a more resistant type of stratified squamous epithelium and at the anocutaneous junction it becomes skin.

Like any mechanism, wear and tear is greatest where the friction of moving parts is greatest. The sphincters, contracted while at rest, act as a shelf for the stool above and expose the mucosa to contact injury by solid particles. Pathological structures act similarly. The voluntary shearing action of the external

* From the Department of Proctology, Detroit Receiving Hospital; a study of seventy-seven cases with the assistance of Howard Keiser, M.D., resident.

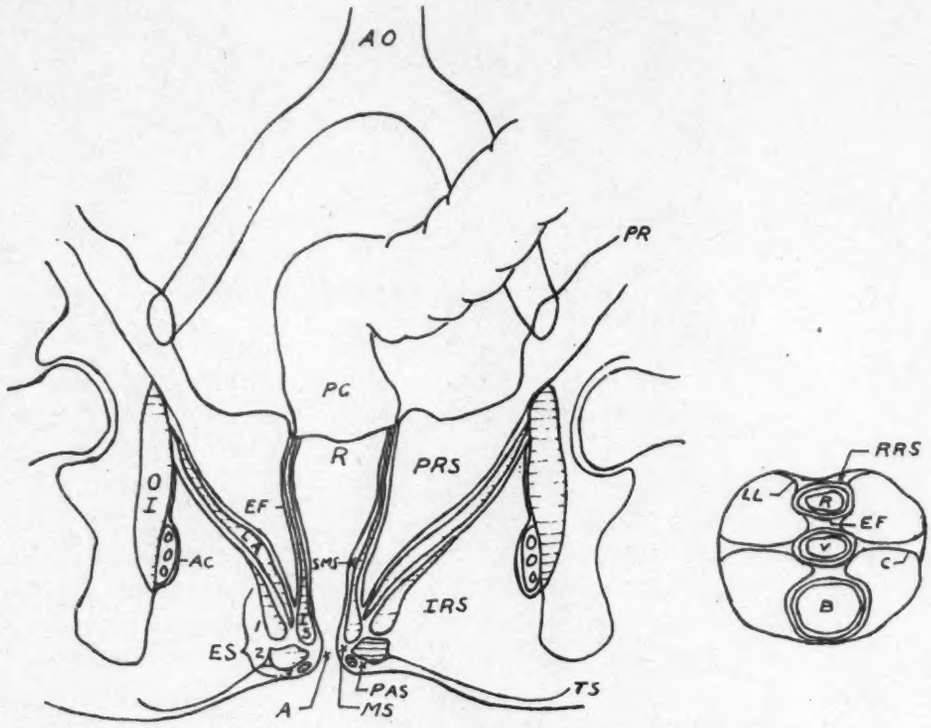

FIG. 1. PRS, pelvifectal space; RRS, rectrorectal space; SMS, submucous space; IRS, ischiorectal space; PAS, perianal space; MS, marginal space; EF, endopelvic fascia; PC, pelvic colon; AO, aorta; TS, tela subcutanea; PR, peritoneal reflection; R, rectum; V, vagina; B, bladder; A, anal canal; LL, lateral ligament; C, cardinal ligament; IS, internal sphincter m.; ES, external sphincter m.; 1, deep; 2, superficial; 3, subcutaneous; LA, levator ani m.; AC, alcock's canal; OI, obturator internus m.

sphincter exposes the epithelium of the anus to direct abrasion. The pull of the levator between the sphincters adds to the danger of a break in the lining. The crypts of Morgagni are at the same level and often become pockets of infection which erode through the lining. Foreign bodies lodge in the crypts and perforate the lining. Prolapsed internal hemorrhoids may become thrombotic and form an ideal medium for bacterial growth.[1]

Foreign body perforation, cryptitis, fissure, ulcer, stricture and thrombotic or eroded hemorrhoids are the common points of origin of anorectal abscesses which begin within the anorectum.

Once infection breaks through, a cellulitis ensues. The inflammatory reaction often seals the point of entrance. The infection spreads outward. Pus forms and follows the path of least resistance. The spread of infection through the wall of the rectum is prevented by the serosa and the enveloping endopelvic fascia; but at the anus these structures are absent giving pus direct access to the anorectal spaces. If the spread is upward under the mucosa, a submucous or intramural abscess of the rectum will form; if the pus breaks through between the internal sphincter and levator ani (pelvic diaphragm), a pelvirectal abscess will result; if this occurs in the posterior midline between the lateral stalks of the rectum, a retrorectal abscess follows.[2] When the spread of pus is downward under the anal lining, marginal and perianal abscesses result. If pus breaks through between the levator ani and the external sphincter, an ischiorectal abscess forms. Once the ischiorectal space is invaded extension may connect any other infralevator space. Pus erosion from an ischiorectal space through or around the medial edge of the levator may extend to any supralevator space. Pus in one ischiorectal space may extend through to the opposite space either in front of or behind the anus, forming an

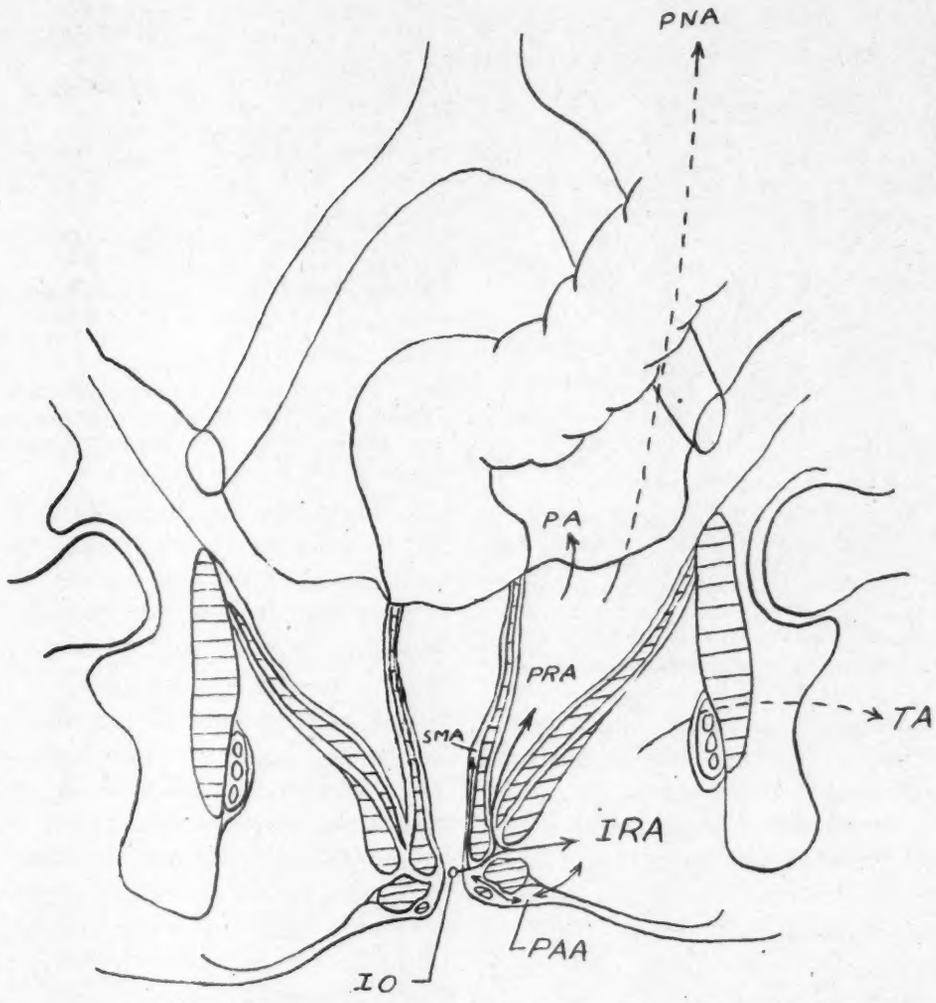

FIG. 2. PAA, perianal abscess; IRA, ischiorectal abscess; SMA, submucous abscess; PRS, pelvirectal abscess; PNA, perinephritic abscess; PA, pelvic abscess; TA, thigh abscess; IO, internal opening.

H-shaped or a "horseshoe" abscess. Figure 2 illustrates these pathways.

Anorectal Abscesses Beginning at the Skin. A break in the skin or an infected skin gland (sebaceous, sweat or apocrine) are the points of origin. Once through the skin, infection has direct access to the perianal space. Perianally, the tela subcutanea is interlaced with fine muscle fibers from the external sphincter, but under the skin of the buttock the tela is interlaced with fatty tissue[16] which offers but little resistance to invasion of the ischiorectal space. Spread from a perianal space can involve any other space and erosion may cause extension in the anorectum to form an internal opening.

Anorectal Abscesses Beginning in the Deep Glands Connected with the Urogenital Tract.[5] (*Fig.* 3). Common offenders are the prostate, seminal vesicles, Cowper's and Bartholin glands. Prostatic abscesses commonly rupture into the urethra, but rupture may occur directly through the rectal wall and but rarely into the perineum and the supralevator spaces. Seminal vesicle abscesses may rupture directly into a supralevator space. Cowper's gland abscesses, situated beneath the main portion of the urogenital diaphragm, have direct access to the related ischiorectal space. Active involvement of a Bartholin gland associated with anorectal abscess has been observed.

Inflammation of the Sacrum and Coccyx (Osteitis and Periostitis).[6] (1) *Pyogenic:*

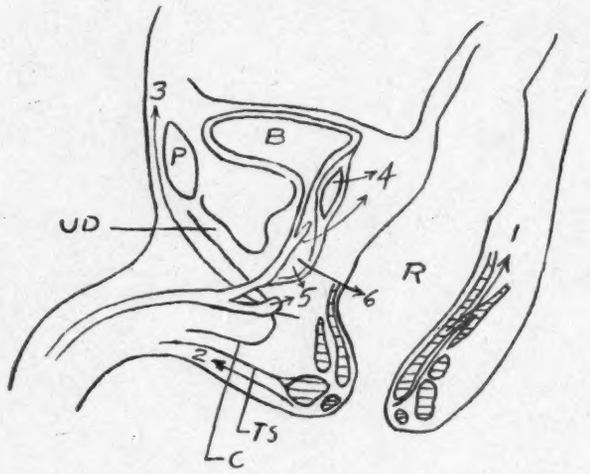

FIG. 3. B, bladder; UD, urogenital diaphragm; P, pubes; 1, to retrorectal space; 2, perianal space to scrotum or labia; 3, through Colle's fascia and superficial perineal space to suprapubic space; 4, prostate and seminal vesicle to supralevator space; 5, prostate and Cowper's gland to ischiorectal space; 6, prostate into rectum; C, Colle's fascia; TS, tela subcutanea; R, rectum.

Suppurative periostitis may begin as a simple or as a purulent inflammation. The pus is formed in the inner layers of the periosteum or between it and the bone. The outer layers of the periosteum may resist the suppurative process for a long time. The accumulation of pus may dissect the membrane from the bone and leave the latter bare. The pus thus formed may remain in this position for a long time, be absorbed or become dry and cheesy; it may burst through the periosteum and lead to abscesses in the soft parts. The bone, if separated from its nutrient membrane, often becomes necrotic and may be absorbed. (2) *Syphilitic:* Syphilitic infection may excite a purulent periostitis. The bone tissue is usually more or less involved. The gummas may be absorbed or may suppurate. (3) *Tuberculous:* Chronic purulent periostitis is frequently associated with the formation of miliary tubercles. Abscesses are apt to form in and about the periosteum and when these are evacuated, granulation tissue containing tubercles may develop.[6]

Pus may spread from the anorectal spaces to the pelvis, perinephritic area, suprapubic area, thigh, scrotum or labia:

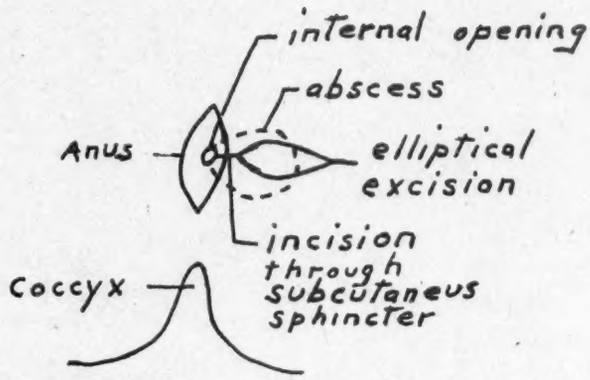

FIG. 4. Perianal abscess with internal opening; elliptical excision of skin forms external opening; wound treated as fistula; incision through sphincter joining external and internal openings.

(1) Pelvic abscess may follow the erosion of pus in a pelvirectal space through the peritoneum into the pelvic cavity. (2) Perinephric abscess may follow the retroperitoneal spread of pus from a pelvirectal abscess to the kidney region.[5] (3) Suprapubic abscess not infrequently follows extension from an ischiorectal abscess. The ischiorectal space is separated from the superficial perineal space (under the urogenital diaphragm) by the reflection of Colles fascia from the scrotum to the posterior edge of the urogenital diaphragm. This prevents extravasated urine from flowing backward into the ischiorectal space and pus from the ischiorectal space from entering the anterior perineum. However, when pus erodes through Colle's fascia from an ischiorectal space into a superficial perineal space, the further spread of pus will be the same as that of extravasated urine, which is along the spermatic cord to the suprapubic area.[10] (4) Scrotal or labial involvement may result from a perianal abscess by the spread of pus along the tela subcutanea to the dartos muscle of the scrotum in the male or to the labia majora in the female. (5) Abscess of the thigh may follow the rare erosion of an ischiorectal abscess through the obturator foramen.[19]

A case in point at another hospital was brought to our attention following autopsy:

Case No. 78502 S.M.H. The patient was semi-comatose; the history was obtained from

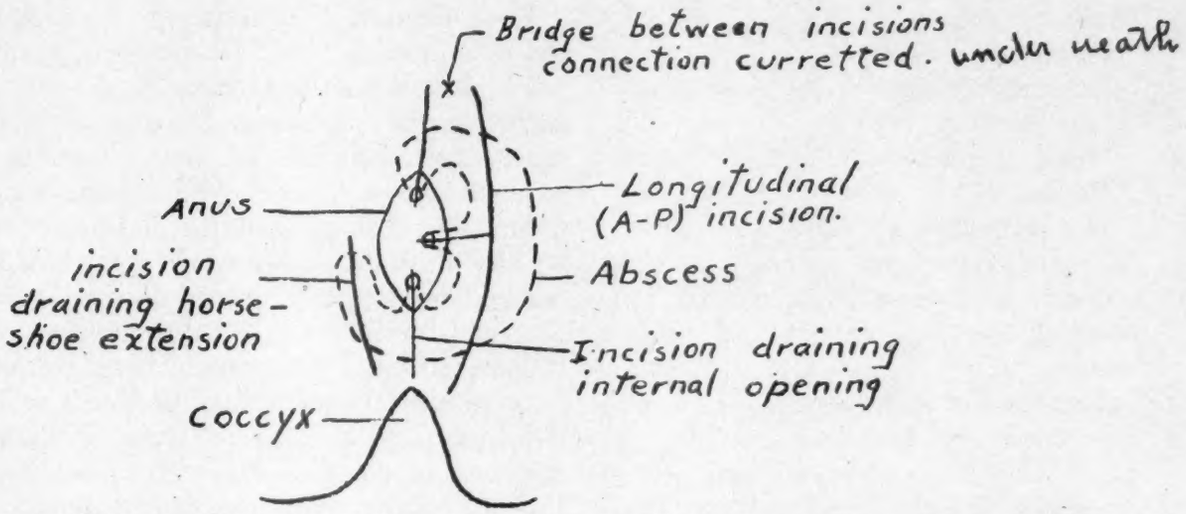

FIG. 5. Ischiorectal abscess showing internal openings at three diagrammatic positions; anteroposterior incisions drain abscess cavity and create external openings of fistula; second incision extends from internal opening to the outside, traversing sphincter fibers at right angle; with good drainage, healing occurs from the inside out, obliterating internal opening.

the physician. The chief complaints were vomiting and inability to urinate.

A perianal fistulectomy had been performed in an office on May 9, 1945. A moderate amount of seropurulent exudate was found in the tracts. After three days of apparent uneventful recovery the patient was unable to urinate and 3 to 4 ounces of urine were obtained by catheter. During the following twenty-four hours, 150 gr. of aspirin were taken for pain. On the fifth postoperative day the patient felt something "give" while straining at stool. He became weak, nauseated and fainted. Shock with persistent vomiting followed and the patient was admitted to the hospital on May 14, 1945. His past history was irrelevant except for the fistula which had been present for ten years.

Physical examination revealed the temperature to be 103.6(R); respirations 28; pulse unobtainable. The skin was moist and cold. Heart and lungs were normal. The abdomen revealed tenderness in the right upper quadrant and flank; there was no mass or rigidity. The back and anorectum were not examined. The patient was restless, irrational, cyanotic, vomited coffee-ground material and expired four hours after admission.

Autopsy showed that in the perianum there were two rather fresh surgical wounds 3 by 6 cm. and 4 by 8 cm. In the abdomen, green yellow pus was found on either side of the rectus sheath to a level 2 cm. below the umbilicus; 50 cc. of purulent fluid was obtained from the right lower quadrant and the adjacent loops of bowel were covered with flecks of yellowish pus. Pus was noted in the soft tissue surrounding the right spermatic cord and the right scrotal sac. Purulent material was noted surrounding both psoas muscles, aorta and right kidney. On the left side of the hip there was a white, indurated, fluctuant area 20 cm. in diameter. Palpation revealed crepitation involving the right side of the trunk, flank, and inguinal region; it extended downward on the anteromedial aspect of the right thigh to the knee.

The clinical picture was suggestive of abdominal pathology; urinary suppression; missed diagnosis due to lack of digital examination; the spread of infection along the anorectal fascial planes to the inguinal area, scrotum, abdominal wall, pelvic cavity, retroperitoneum, perinephreum and thigh.

A review of seventy-seven successive cases of abscess of the anorectal region from the Proctology Service of Dr. E. G. Martin at Receiving Hospital in Detroit over a period of two years revealed the following:

1. Sex: Males 41, Females 36
2. Age groups:

Age:	0–10	10–20	20–30	30–40
Cases:	2	4	25	24
Age:		40–50	50–60	60–70
Cases:		13	7	2

3. Type:
   Perianal 28
   Ischiorectal 36
   Supralevator 13
4. Internal opening:
   Present in 28
   Not found in 49
   In eight cases the internal opening was due to a pre-existent fistula. Two internal openings were found in one case.
5. Seton: used in four cases
6. Operative Complications:
   (a) A chicken bone was found in two cases of ischiorectal abscess; thorough search did not reveal the internal opening (point of origin of infection) through which the bone left the anorectum.
   (b) Three patients with supralevator abscesses were admitted near extremis requiring transfusions and supportive therapy previous to surgery. Two recovered; one expired on the third day in spite of two attempts to secure drainage.
   (c) In two cases of perianal abscess, repeat surgery was necessary five days later for supralevator abscess.
   (d) In two cases of ischiorectal abscess, direct extension was found in the superficial perineal space, in the scrotum, along the spermatic cord and in the suprapubic space; in a severe diabetic, extension continued up the abdominal wall to the lower rib margin but the patient recovered.
   (e) The coccyx was removed in one case.
7. Results: (Clinic records were available in forty-five cases).
   (a) Fistula: 3
   (b) Inactive indurated area: 1
   (c) Cellulitis: 1; subsided without repeat surgery
   (d) Stricture: 2; one ascribed to lymphopathia
   (e) Incontinence: temporary in 1; partial in 1

The diagnostic criteria of anorectal abscesses include fever, leucocytosis, toxemia and local manifestation. The marginal perianal and ischiorectal varieties are self-evident because of pain, swelling, induration and redness. The supralevator group offer a more complex picture; pain is absent until downward spread has reached the sensory nerves of the anus; the chief complaint is rectal discomfort or fullness; toxemia is apparent; meningismus may appear; peritonitis produces abdominal pain and ileus; fever is high; diarrhea is common due to a localized procoto-colitis; palpation of the buttock on the affected side offers resistance due to levator spasm with but little tenderness; the skin is warm; digital examination reveals internal heat, induration of the rectal wall or bulging and fluctuation.

Treatment is adequate surgical drainage predicated on a knowledge of the anorectal spaces and their connecting pathways. The process of erosion must be reversed to one of granulation. An abscess cavity will granulate and heal in an inverse ratio to the size of the drainage incision.[13] Débridement shortens morbidity; necrotic tissue should be excised and not left to slough; pockets must be obliterated. Remaining devitalized tissue is manifested by a continued toxemia from its absorption. Surgical exposure must be sufficient to reveal an extension to another space.

Previous to the drainage of any anorectal abscess, adequate dilatation and thorough search of the anorectum should be done to reveal any existent internal opening. Crypts, ulcers and fissures are common sites of an internal opening. A sealed internal opening will usually become patent by adequate dilatation with a bi-valve speculum (spinal anesthesia prevents disruption of sphincter fibers) aiding pus to appear at the internal opening.[18] Any irregularity in the anorectal lining should be investigated with a crypt hook. Often light scarifying of a suspicious area will be rewarded by the appearance of pus. If an internal opening is overlooked, the

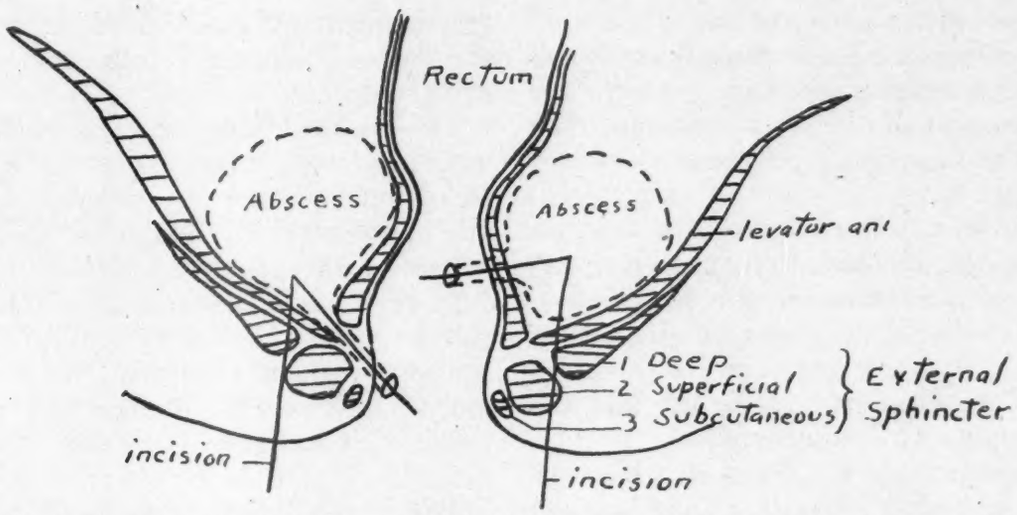

FIG. 6. Supralevator abscess. Anteroposterior incision through skin posterolateral to superficial external sphincter extended upward into abscess cavity by puncturing levator ani muscle completes fistula formation; superior half of all muscle fibers inside the loop of the fistula are divided at the first stage; seton placed around the external muscle fibers and skin. With low internal opening the operation may often be completed at one stage.

skin incision forms the external opening of a fistula which may heal with the drainage of pus but is prone to redevelop some months later.[4] An internal opening must be extended to the outside unless a fistulectomy is planned at a later date. An internal opening may be the point of origin of an abscess, or it may be the site of erosion. As a general rule, the external skin incision is made in the same manner, whether an internal opening is present or not.

Perianal abscesses respond well to radial drainage. Drainage of this type should be by elliptical excision of skin rather than incision. The radial incision is closed by postoperative contraction of the sphincter, whereas radial elliptical excision, completely unroofing the abscess, maintains adequate drainage. Plastic effect and the avoidance of nerve injury are the advantages of radial drainage when contrasted to a longitudinal incision lateral to the sphincter fibers.

In 1922, D. C. McKenney advocated the treatment of small abscesses as fistulas.[14] An internal opening associated with a perianal abscess requires but little added surgery. The abscess usually occurs opposite the internal opening. If the abscess has not ruptured, anal dilatation will cause pus to escape at the site of the internal opening. An elliptical excision of skin in a radial direction unroofs the cavity; the connection between the cavity and internal opening is confirmed by probe or peroxide injection. If incontinence does not threaten (the internal opening is rarely deep in a perianal abscess), the interposing sphincter fibers are incised at a right angle and the "mucosa" about the internal opening excised, as in Figure 4.

Ischiorectal abscesses respond best to a longitudinal anteroposterior incision (along the long axis of the ischiorectal space) throughout the length of the abscess. When the anus contracts postoperatively it retracts the medial edge of the incision, pulls the wound edges apart and thus maintains drainage. If the entire width of the ischiorectal space is involved, a lateral extension forming a "T" will prevent an overhanging lip under which purulent material may collect. The pudendal nerve, which crosses the space from Alcock's canal to a superficial position at the anus, should be protected to avoid a flaccid sphincter.

Counter drainage and button hole drainage are to be deprecated. They invite recurrence because they allow a roof to

persist over an infected tract; they do not lend themselves to adequate investigation for extension to other spaces; they allow erosion of tissue to continue; they lead to an increased incidence of secondary fistulectomy.

Treatment of an ischiorectal abscess complicated by an internal opening requires both an external skin incision and one extending from the internal opening at a right angle through an involved sphincter. Thus two separate incisions are made; any intervening skin is thoroughly curetted following débridement. (Fig. 5.) Anal dilatation will usually reveal pus at the internal opening even though it may have become sealed. A probe is helpful in determining a connection. The injection of peroxide of hydrogen into an opening with slight pressure may disclose a patent opening at the opposite end of a tract.

An ischiorectal abscess may erode through Colles fascia deep to the transverse perinei musculature into the superficial perineal space of the corresponding side and may then follow the fascial reflections to the scrotum or labia and along the spermatic cord to the suprapubic space of the abdominal wall. Such extension requires multiple incisions of the involved areas. The transverse perinei muscles are not divided. Properly drained, the wounds heal from within, at times leaving a short, completely external fistula under the skin bridge which can be opened later with local infiltration. When too great a portion of the sphincter fibers are involved in an anterior area, the internal or deep fibers are divided and a seton placed around the superficial fibers and intervening skin. Later, when the divided muscle has reunited, the superficial sphincter fibers and skin, encircled by the seton, are divided. The wound edges are separated daily thus permitting the wound to granulate and heal. (Fig. 5.)

Pelvirectal and retrorectal abscesses should be drained from without. A long incision is placed lateral to the anococcygeal ligament and external sphincter fibers; the levator ani muscle is punctured bluntly and the opening widened.

The surgical treatment of pelvirectal supralevator abscesses associated with internal opening requires staunch courage and adherence to principle. Jackman, in his recent article on fistulas, states, "Another reason for anal incontinence is permitting the inflammatory process to continue without treatment. In so doing, much more scar is formed and muscle tissue itself is destroyed by the pathologic process. . . . If the fistula is to be cured, all the tissue overlying the fistulous tract must be incised whether or not muscle intervenes."[11] To drain the abscess externally and leave the internal opening invites recurrence and deep fistula formation. With incision and drainage established through the skin and levator muscle, a fistula has been created. Surgical correction for the fistula can then be instituted immediately. There is no need to postpone this phase of the operation until infection has subsided and a tract has formed. With immediate incision of the encircled tissue more adequate drainage is accomplished resulting in less tissue destruction and fibrosis. An incision made in the levator tends to close quickly and form a bottleneck requiring secondary incision; this danger does not exist if immediate incision of the encircled tissue is instituted. If the internal opening is high and the tract is superior to a major portion of the sphincter, a two-stage incision with seton may be used. (Fig. 6.)

Judgment as to the immediate incision of the encircled sphincter fibers or the two-stage division with seton is dependent upon three factors: (1) Evaluation by palpation of the percentage of sphincter fibers lying superficial to a probe placed in the tract as compared to the amount of sphincter lying deep to the probe;[13] (2) division of sphincter fibers at a right angle; and (3) radical incision permitted in the posterior midline with increased

conservatism and use of the seton as the anterior midline is approached.[13]

The use of rubber drains implies inadequate surgical drainage. They have their indication in establishing a sinus through the levator but do not replace passing a gloved finger throughout the tract every one or two days.[19] Gauze packs help to control bleeding the first twenty-four hours; beyond that time they counteract drainage.

An adequately drained abscess heals promptly. Inadequate drainage manifests itself after four days by persistent pain and tenderness, indurated wound edges, purulent discharge, fever and toxemia. If these findings are present, drainage has been inadequate for one of the following reasons: (1) overhanging flap, (2) agglutination of the sides of the incision (insufficient separation with gloved finger), (3) persistent necrotic tissue in the cavity (incomplete débridement), (4) extension of infection to another space, (5) unsuspected internal opening, (6) persistent focus of infection, as an infected coccyx or urogenital gland, and (7) systemic disease such as tuberculosis, syphilis, diabetes or Bacillus Welchii infection.

SUMMARY

Infection gains entrance to the anorectal spaces from the anorectal lining, the skin, the glands of the urogenital tract or an infected coccyx and sacrum. Pus localized in the anorectal spaces to form abscesses, spreads along fascial planes to definite areas, namely, the perinephreum, pelvic cavity, thigh, scrotum or labia, along the spermatic cord and the abdominal wall. Treatment is radical drainage to the outside. Emphasis is placed on the search for an internal opening previous to surgical drainage. As a general rule, the external skin incision is made in the same manner whether an internal opening is present or not. If an internal opening can be demonstrated, external drainage alone will be followed by fistula. To avoid fistula formation, internal openings are included in the surgical correction of the abscess, following the same rules as apply to fistula. Surgical drainage should be so radical that reliance need not be placed on rubber drains or gauze packs.

REFERENCES

1. Alexander, Samuel. *Med. Rec.*, 68: 685–690, Oct. 28, 1905.
2. Bacon, H. E. Anus, Rectu, and Sigmoid Colon. Philadelphia, J. B. Lippincott Co., 1941, 2nd Edition.
3. Bochner, S. Judd. Ischiorectal abscess. *Am. J. Surg.*, Apri , 1937. 36: 279–282.
4. Brust, J. C.-Anal abscess and fistula. *New York State M. J.*, Feb 15; 37: 400–402, 1937.
5. Callander, C. I. Surgical Anatomy. Philadelphia, 1941. W. B. Saunders Co.
6. Delafield and Prudden. Textbook of Pathology. Baltimore, 1931. Wood and Co.
7. Diamond, A. and Laufman, H. Perinal infection. *Am. J. Digest.*, 8: 252–255, July, 1941.
8. Fansler, W. A. Fistula and abscess. *Am. J. Surg.*, 56: 144–153, April, 1942.
9. Gillespie, W. F. Perinal abscesses. *Canad. M. A. J.*, 47: 547–551, Dec., 1942.
10. Grant, J. B. Method of Anatomy. Baltimore, 1938. Wm. Wood & Co.
11. Jackman, Raymond J. Anal fistulas. *Am. J. Surg.*, 68: 323–325, June, 1945.
12. Levy, Edward. Anorectal musculature. *Am. J. Surg.*, 34: 141–198, Oct., 1936.
13. Martin, E. G. Personal communication.
14. McKenney, D. C. Discussion of anal abscesses. *J. Am. Proct. Soc.*, 73, 1922.
15. Morrissey, J. H. *Surg., Gynec. & Obst.*, 46: 341–351, March, 1928.
16. Morriss. Human Anatomy. Philadelphia, 1925. Blakiston.
17. Pruit, Marion C. Ischiorectal abscess. *Am. J. Surg.*, 46: 669–673, Dec., 1939.
18. Stewart, John D. Fistula in ano. *Tr. Am. Proct. Soc.*, 1925.
19. Yeomans, Frank C. Proctology. New York, 1929. Appleton-Century.

DISTAL ECTOPIC PREGNANCY*

IMPLANTATION OF THE OVUM IN THE CERVICAL MUCOSA

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UNDER normal conditions the corpus uteri, vested with a mucosa especially suitable for the requirements of pregnancy, provides the exclusive ground for placentation; the isthmus which is incorporated at an early time into the cavity harboring the fetal sac, serves only for the attachment of the membranes; the cervix has nothing to do either with the membranes or the ovum. In pregnancy it serves to occlude the uterine cavity towards the outside; during parturition it forms a part of the birth canal.

Under exceptional and rare circumstances, however, the fertilized ovum may embed itself in the mucosa of the isthmus or of the cervix. Although the nidation in the isthmus is, no doubt, a pathologic one, it is not to be regarded as ectopic; since by its very nature the isthmic mucosa represents a corporeal mucosa, differing from the actual endometrium corporis by its lesser development and a certain functional weakness. The cervical mucosa, on the other hand, differs basically from the mucous membrane of the corpus and isthmus. It does not pass through phasic changes and is in no way equipped to nourish the ovum or to fulfill the other requirements which the growing fetus demands of the maternal tissue. For this reason this type of pregnancy is a true ectopic pregnancy and as against the ectopic pregnancy proximal to the uterine body, to be termed distal ectopic pregnancy. This designation is furthermore justified by the fact that the pathological changes associated with this ectopic gestation are fundamentally the same as those of a tubal pregnancy, consisting in destruction of its nutrient medium and an almost regularly premature termination by internal or external rupture of the gestation sac. The structure as well as the topographical position of the cervix, however, bring about differences which are conspicuous especially on viewing the clinical picture.

Theoretically, the possibility of implantation of the ovum in the cervix was acknowledged for a long time, but its actual occurrence was considered improbable and not proved. Ahlfeld and Aschoff were of the opinion that although the occurrence of a cervical pregnancy must be accepted as possible, still, up to 1904, no proof had been given to show that the ovum could have been implanted in the cervical mucosa after having passed the internal os. Likewise Pankow stated in 1927 that a true cervical placenta, implying that the ovum was exclusively and completely lodged in the cervix, and that the primary implantation took place there, too, has so far never been observed with certainty. In Davis' Gynecology of 1934 we find the following statement: "Cervical pregnancy is an almost unbelievable phenomenon, but, nevertheless, a few cases have been reported."

It was the publication of a case of a two months old pregnancy in the portio vaginalis cervicis uteri in 1926 which enabled me for the first time to establish evidence that an implantation of the ovum in the cervix actually does occur. On reviewing the literature existing at that time about sixty cases of pathologically distal pregnancies were found. We were surprised that in none of these cases had an exact proof of exclusive cervical placentation been offered. Shortly before this, Mueller arrived at the same conclusion in a critical review of literature. In 1942, a case of cervical

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pregnancy, published below, came to my knowledge, which induced me to look into and check the entire pertinent literature since 1926, to see how far evidence of a primary cervical implantation could be accepted from the existing descriptions. From a total of thirty cases published as cervical pregnancies, I believe that I am able to show that there are ten cases of provable cervical implantation. These cases together with the one published here and the one observed by me previously—altogether twelve—form the basis for the present observations on cervical implantation of the ovum.

CASE REPORT

This was a patient of Dr. Kurt Frachtmann, of New York, who has kindly permitted me to present the case.

On February 12, 1942, he was called to a patient because of severe vaginal bleeding. The patient was a forty-year old woman who, to date, had been essentially healthy, and, above all, had never had any gynecological disturbance. Once, seventeen years previously, she had had a normal delivery. During the last year she had had sexual intercourse without contraceptive precautions. Menstruation had always been regular, every four weeks and of four days' duration. The last normal menstruation had occurred on December 20, 1941, had been of normal duration and of normal amount. In spite of the cessation of menstruation in January, the patient felt well. The skipping of menses was mistaken by the patient for a sign of menopause.

On February 12, 1942, about seven weeks after the last menstruation a vaginal hemorrhage started suddenly, about noon, not preceded by cramps and not associated with any other symptoms. The flow was from the start heavier than a menstrual period. The patient, therefore, went to bed and called the doctor. When the family physician saw her two hours after the hemorrhage had started, the under-sheet was already soaked with blood. In view of the violent bleeding, and of the fact that a period had been missed, the doctor assumed an ordinary abortion and called the gynecologist without having examined the patient vaginally.

The gynecologist saw the patient three hours after the onset of the hemorrhage. She was a delicate, fairly well nourished woman, resting quietly in bed, apparently in shock from hemorrhage. The skin was pale and cool to touch. The forehead was covered with perspiration. The pulse was 130 and thready. There was a puddle of blood between the thighs.

On vaginal examination the vagina was distended with blood clots. The cervical orifice was open two fingers, and the cervical rim was thin. One gained the impression of a crater within the cervix, reaching upwards 2 to 3 cm. The wall of the crater felt firm and in some places even hard. At one spot (between 6 and 9 o'clock) a tumor-like growth was palpable, firmly attached to the cervical wall, and friable on its surface. A vigorous manual exploration of the crater was avoided in order not to irritate the apparent source of the bleeding any more.

The patient was immediately transferred to the hospital, and orders were given by telephone to have the operating room ready for a vaginal packing. A preliminary diagnosis of endocervical, disintegrating, profusely bleeding tumor was made.

After arrival of the patient at the hospital, the bleeding became less profuse. On bimanual examination an enlarged and anteflexed uterine body could be felt. The consistency was normal, rather hard. The adnexa and parametria were normal.

On inspection, the vagina disclosed a moderate amount of liquid blood along its walls. The uterine orifice was dilated 2 or 3 cm., and its margin was thin and smooth. The cervical walls were grasped with three vulsella and pulled downward and apart. The inside of the cervix became clearly visible. The cervix was filled for the most part with a disintegrated, tumor-like, blood imbibed mass, about the size of a walnut. The base of the tumor reached downward close to the uterine orifice, from which it was separated only by a 1 to 2 mm. wide, pale mucosal area. To the left and above the tumor one could reach with a probe into the upper part of the cervical canal, passable by a Hegar probe No. 5. The distance between the external cervical orifice and the beginning of the canal above the tumor was 4 cm. and between the external orifice and the fundus uteri, 8 cm. The base of the tumor was grasped by two clamps and the tumor was forcibly

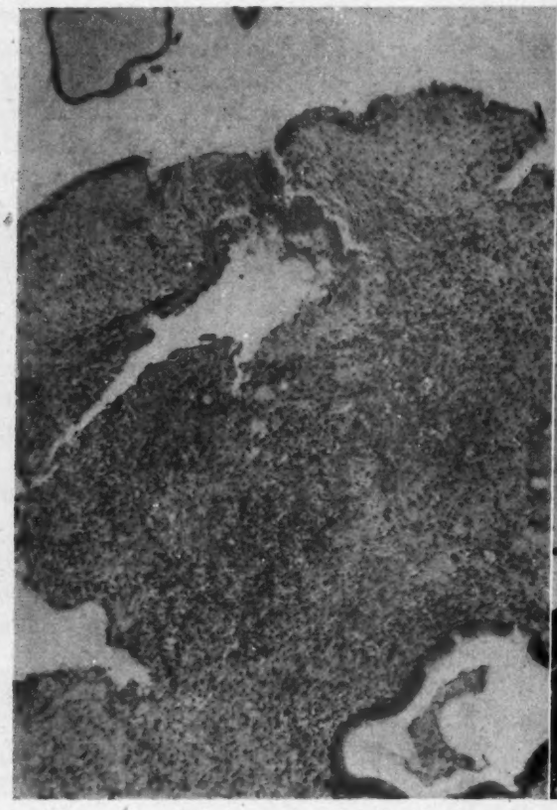

FIG. 1. Cervical tissue showing decidual reaction at the peaks of the mucosal folds.

FIG. 2. Decidua cells with villus nearby (enlarged from Figure 1).

removed. After the removal of a few strongly adherent remnants from the wall, and after tight packing of the cervix and the vagina, the bleeding stopped.

A transfusion was given. The blood findings before the transfusion were: 2 million red blood cells and 57 per cent hemoglobin. Recovery was uneventful. The packing was removed on the third day. During the following days there was abundant bloody discharge.

Five weeks later the portio vaginalis appeared normal on inspection. The next menstruation came six weeks after this event. The histological examination of one of the removed tumor particles revealed, in contrast to the preliminary diagnosis, a clear picture of a pregnancy in the cervix.

Histological report (Figs. 1 and 2) by Dr. Alfred Plaut was as follows: The slide is stained with hematoxylin-eosin. There is cervical tissue which can be definitely recognized by characteristic glands and by the surface epithelium. The cervical stroma, however, is completely altered by edema, inflammation and hemorrhage. Numerous, large, compact, mononuclear cells are scattered through the stroma. They obviously are decidua cells. No chorionic tissue can be found in the cervical tissue. Other pieces, however, consist of young placental tissue. The double layer of epithelium is distinct on most of the villi. There are rather large masses of chorionic epithelium. There also is a fragment of the fetal sac.

An implantation of the ovum in the cervix can be assumed only if proof can be given that the site of the placenta lies exclusively within the cervix. The most important prerequisite for this evidence is the possibility of delimiting anatomically the site of the placenta within the cervix, from the isthmus and the corpus. The discussion of a few anatomical facts concerning the cervix and the isthmus in the pregnant and non-pregnant uterus seems imperative in understanding this issue.

Isthmus in Non-pregnant Uterus. The isthmic canal forms the upper continuation of the cervical channel; together with it, it constitutes the tubular portion of the uterus. Its boundary towards the uterine body is defined macroscopically by the

orificium isthmi internum, i.e., the transition of the tubular portion into the triangular slit of the corporeal cavity. Looking at a frontal section through the uterine cavity in its premenstrual stage, the increase in thickness of the mucosa which is poorly developed in the isthmus, is conspicuous in this part, caused by the clear appearance of a functional layer, typical of the corporeal mucosa. Aside from these macroscopically visible characteristics, the demarcation of the isthmus towards the corpus, as well as towards the cervix, can be verified only microscopically. The isthmus is lined with a sort of mucosa similar to that of the corpus, but with important and obvious differences which need not be discussed in detail at this point. The phasic change of the isthmical glands is rudimentary in comparison with that in the corpus. The isthmic mucosa remains almost the same low layer even during the menstrual cycle, and in no way joins in the formation of a nidation bed. In the gross the isthmus forms a unit with the cervix, but histologically it forms a unit with the corpus.

Isthmus in the Pregnant Uterus. In pregnancy, too, the development of the isthmic mucosa lags far behind that of the corpus. The decidual reaction of the isthmus is generally very scanty or may be completely absent. The morphologic unity of the isthmus with the cervix is regularly abandoned at an early stage of pregnancy, whereby the tubular isthmic segment becomes gradually unfolded, forming ultimately the lower pole of the breeding cavity harboring the fetal sac. Though it is still claimed by many that the unfolding starts only from the fourth month, investigations by Stieve have proven that the unfolding of the isthmus starts as early as the third month and is complete at the end of the third month. The unfolded isthmus is then known as the lower uterine segment. Macroscopically, its demarcation towards the cervical canal is now definitely possible in that the unfolding stops abruptly at the orificium cervicis internum. Histologically,

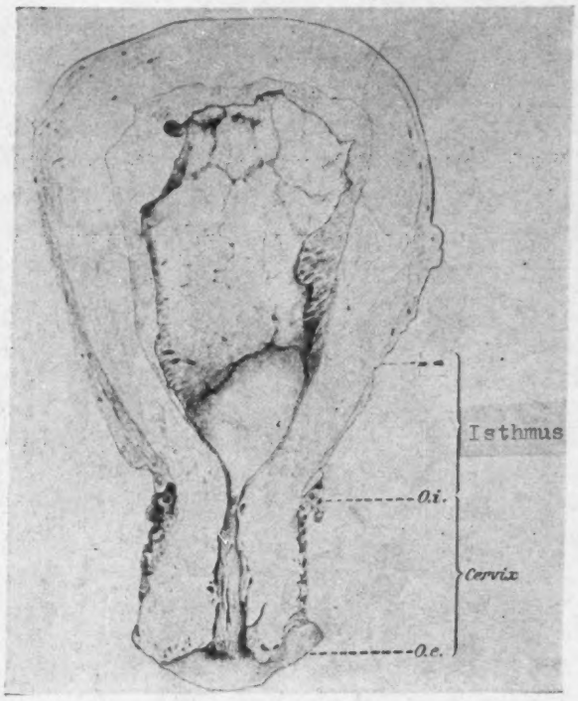

Fig. 3. Pregnant uterus two to three months showing thin mucosa in lower uterine segment (isthmus) (according to H. R. Schmidt).

the isthmus can be delimited towards the cervix proper at any time during pregnancy, exactly as in the non-pregnant uterus. Upwards, against the corporeal mucosa, however, the demarcation of the isthmus after its absorption into the corporeal cavity is harder to demonstrate. When a decidual reaction in the isthmus is absent, a differentiation between the thick gestational endometrium and the thin isthmic mucosa is clearly apparent even macroscopically. (Fig. 3.) The ability to differentiate between isthmus and corpus, however, varies widely and becomes problematic even on microscopic examination, with progressing pregnancy.

Isthmic Placenta. If occasionally this area of mucosa becomes the site of a placenta, and the structure of the mucosa is thereby changed to a great extent, an exact delimitation between the isthmic and corporeal mucosa becomes almost impossible. However, such a placenta can unquestionably be recognized as an isthmus placenta on account of its location at the lower pole of the uterine cavity. Formerly it was thought that one would be able, on

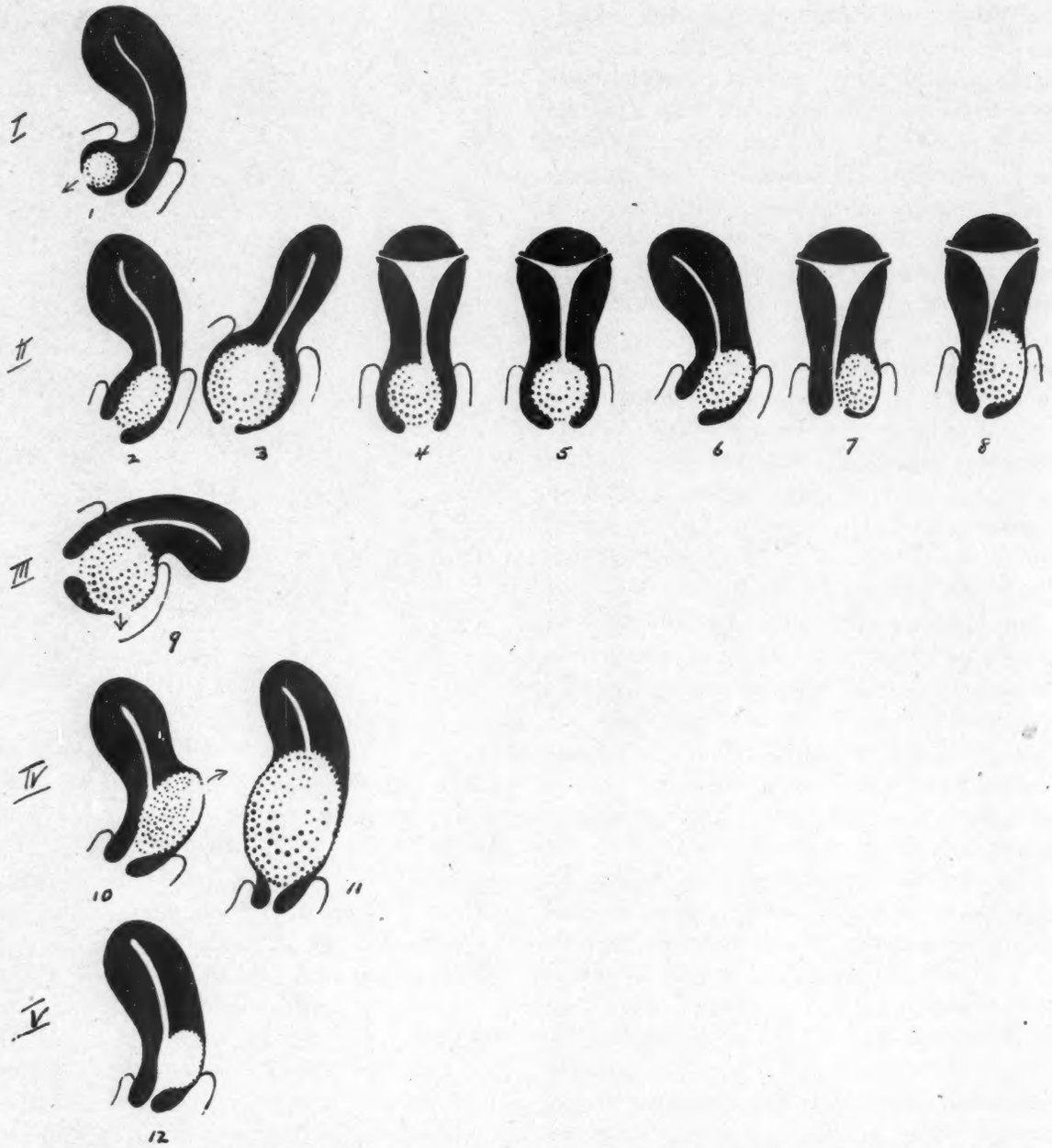

FIG. 4. Diagrams of Cases 1 to 12. I, 1, Otto; II, 2, d'Aprile, 3, Fearl, 4, Frachtman, 5, Gheorgiu, 6, Gimpelson, 7, Schneider, 8, Stresoff; III, 9, Gergely; IV, 10, Szenteh, 11, Meyer; V, 12, Steinbiss.

account of certain external signs, regarded as characteristic, to determine the boundary between the isthmus and corpus, even when the microscopic examination failed to do so. These signs included the course of the circular vein, the reflection of the peritoneum and the site of the entrance of the uterine artery. Thorough investigations, however, have shown that these characteristics are unreliable. Furthermore, the fact that a contraction ring or even a larger contracted portion of the uterus can be distinguished above the isthmic placenta, can in no way be used as a demarcation line between isthmus and corpus.

From these considerations it follows that a placenta, primarily developed within the isthmus, having its origin in the implantation of the ovum in the isthmic mucosa, cannot practically be differentiated from a secondary isthmic placenta originating from the corporeal mucosa and trespassing secondarily on the isthmus, once the placenta spreads over a large area.

Cervical Placenta. The conditions are similar in the case of cervical placenta. The gross anatomical site of the placenta in the cervix, the rim reaching far down, close or right down to the external orifice, permits the exclusion of any doubt in the diagnosis of this rare placental site. The establishment of the fact, however, that the placenta is situated in the cervix, is not sufficient to answer the question of a cervical implantation of the ovum in the affirmative. This is only possible, as already mentioned, if the placentation is completely and exclusively limited to the cervix. It turned out in the study of the literature that in cases of placentas developed beyond the third month of gestation, it was impossible to prove that the upper limit of the placentation lay within the cervical mucosa. Once the development of the placenta has progressed so far that the isthmus is, for the most part, involved in the chorionic invasion, we are no longer justified in terming the cervical placenta a primary cervical placenta. In the inexact interpretation of the concept of cervical placentation lies, in my opinion, the most frequent cause for misunderstanding, when the question of cervical pregnancy comes up for discussion. We should not designate as a cervical pregnancy a pregnancy which, on account of its gross anatomical appearance apparently lies in the cervical portion of the uterus, but only that kind of pregnancy which originated through implantation of the ovum in the cervical mucosa (sometimes called true or primary pregnancy).

Corpus—Isthmus—Cervix Placenta. As in the first series of distal implantations of the ovum, reviewed up to the year 1926, we find in the cases of alleged cervical pregnancies published since, a considerable number which ought to be put into the group of corpus-isthmus-cervix-placenta (listed in Table III). It may be strongly emphasized at this point that the possibility of a primary cervical implantation with consequent proximal extension into the corporeal mucosa in a number of these cases, should not be denied nor can it be ruled out. The following three typical cases of this group demonstrate that these cases can in no way be considered as cervical implantations, because of lack of evidence of a total and exclusive placentation in the cervix.

1. Crousse published a case as a cervical pregnancy which bled to death in the third to fourth month of gestation after separation of the placenta. The postmortem examination of the uterus revealed without difficulty that, although the placenta reached distally right up to the external orifice, it extended upward beyond the isthmus and into the corpus. As in so many similar cases, a histological verification of the boundaries of the placentation was not even attempted.

2. Reist described the case of a five-months old cervical gestation which terminated by miscarriage. The digital exploration of the uterine cavity after removal of the fetus revealed changes which were reconstructed in a drawing. The cervix formed a huge, loose, thin-walled sac, above which a firm, thick-walled uterine body, the size of a fist, could be felt. Although any anatomical verification of the cervix-corpus boundary is lacking, this case is presented by the author as a case of "rare ectopic pregnancy in form of graviditas cervicalis primaria." In contrast to these two cases representative of a group not examined anatomically, but classified as cervix-corpus placenta, there is one case of histologically examined cervix-isthmus placenta.

3. Kleiner reports a two to three-months old pregnancy, in which the uterus had to be extirpated on account of a severe hemorrhage. The clinical picture as well as the far distal site of the placenta suggested the possibility of a primary cervical pregnancy. The microscopic examination, however, disclosed definitely that the placentation had trespassed the area of the cervix upward, and had involved the entire isthmus.

Cervical Implantation. The placental site in the cervix may not or may only barely trespass the boundary between the cervix and isthmus if the development of the placenta is to be correlated to an implantation of the ovum in the cervix. On the extirpated or postmortem specimen the

microscopic evidence of this boundary is indispensable for the diagnosis of a cervical pregnancy. In case of an early pregnancy situated in the distal portion of the cervix, and accessible only to clinical exploration, the presence of an intact upper portion of the cervix-isthmus-canal is sufficient, if considered in connection with the other observations (age of pregnancy, size of the ovum, measurements).

TABLE I
PROVED CERVICAL IMPLANTATIONS

Author	Year
1. Schneider	1926
2. Stresoff	1927
3. Steinbiss	1928
4. Meyer	1929
5. Szenteh	1933
6. Otto	1934
7. Gheorgiu and Protopopesku	1935
8. Gergely	1935
9. Gimpelson	1936
10. D'Aprile	1937
11. Fearl	1945
12. Frachtman	1946

The twelve cases of cervical implantation meeting such requirements are listed in Table I in the order of their time of publication. Table II includes those cases to which a certain probability of being cervical pregnancies may be ascribed on account of clinical observation. In these cases, however, anatomical examinations are completely lacking, or those presented are insufficient.

TABLE II
CLINICALLY POSSIBLE CERVICAL PREGNANCIES BUT WITHOUT ANATOMICAL EVIDENCE

Author
1. De Michele
2. Tropea (first case)
3. Bolaffi
5. Schürger
6. Wittrin
7. Studdiford (second case)*

* This case of Studdiford, according to my personal belief, represents a fairly certain case of a cervical implantation because of the fact, not known to occur in any other condition, that there was a rupture into the vaginal fornix. Since, however, the case lacks any other anatomical data except (1) pregnancy in the cervix and (2) rupture into the vagina, I did not venture to classify it as a proven cervical implantation.

Pathological Anatomy. Upon attempt to give a comprehensive picture of the pathological anatomy of cervical gestation, it must be emphasized that this presentation suffers from the shortcomings of too few observations and from the regrettable fact that the reports on histological examinations are short and incomplete. Systematic investigations of this rare form of pregnancy are almost completely lacking. The existing findings are furthermore inadequate because they are, by nature, confined to microscopic examinations of the placental bed following separation of the ovum, at which time the tissue to be examined was disarranged through formation of hematoma and other injuries. The histologic examination of a case of intact cervical pregnancy in an early stage, is still lacking.

TABLE III
CORPUS-ISTHMUS-CERVIX PLACENTAS

Author
1. Jolkin
2. Gänsbauer
3. Tropea (second case)
4. Kleiner
5. Vaudescal
6. Andrei
7. Crousse
8. Tarleton
9. Desirotte
10. Reist
11. Studdiford (first case)

The more distally in the cervix the pregnancy is located and the earlier the time it comes to our attention, the more convincing and simple is the proof of cervical implantation. More than half of the cases reviewed here are observations

TABLE IV
CERVICAL ABORTION

Author
1. Hyslop
2. Bacialli

of pregnancies in the vaginal portion of the cervix between six and eight weeks old. However, there was also a case of a twelve-weeks old pregnancy in the vaginal portion (published by Gergely). The remaining cases concern cervical pregnancies of ten to twelve weeks, which reach upwards to the isthmus.

Dividing the cervix for descriptive purposes into anterior, posterior and two

lateral walls, we find only in one single case the site of the pregnancy in the anterior wall (Otto). In all other cases the posterior and lateral walls of the cervix were involved in the placentation, with the exception of two cases (Gheorgiu, Meyer), in which annular placentation was observed. This distribution of the placental site is in contrast to the one in the corpus where anterior and posterior walls are equally often included as sites of implantation.

Arranged according to age and topography, the twelve cases of cervical pregnancy can be comprised in the following five groups (Fig. 4):

1. *Case of Otto:* The most distally located pregnancy ever observed is described by Otto, situated in the anterior cervical lip. It was a six-weeks old pregnancy which, like a tumor, expanded the anterior wall of the vaginal portion, forming a cherry-sized nodule. This extremely distally situated ovum had, at the time of the observation, perforated into the vagina through a lentil-sized opening, causing a severe hemorrhage. The amputation of the vaginal portion and its histological examination by serial sections disclosed an exclusive and complete placentation within the cervix.

2. *Cases of Aprile, Fearl, Frachtmann, Gheorgiu, Gimpelson, Schneider, Stresow:* This group includes the majority of cases here described, and presents what might be considered the typical picture of cervical pregnancy. These are the cases of six to eight-weeks old pregnancies, almost exclusively, or for the most part developed within the vaginal portion of the cervix. The site of the placentation reached downward right to the external os (or within 1 to 6 mm.) and was separated above from the corpus cavity by an intact isthmic canal. In four cases this was proved by clinical observation which disclosed above the site of placentation the presence of a canal either closed or open to a Hegar probe No. 5. In two cases of this group, histologically examined after extirpation of the uterus, the isthmus appeared free of chorionic elements. In one case (Fearl) a statement could not be found regarding a cervical-isthmic canal above the ovular bed, nor was the upward boundary defined histologically. Nevertheless the pregnancy has to be considered as confined to the vaginal portion of the cervix from the following facts. The cervix was enlarged to a tumor filling the whole vagina. The tumor consisted of a thin shell of cervical tissue and enclosed the fetal sac which reached right down to the external os. As the fetus was found to measure 15 mm. in length, corresponding to an age of seven weeks, the external dimensions of the ovum could hardly have exceeded 40:35 mm. and, therefore, must have been lying within the distal portion of the cervix.

At the time of observation, in five cases the fetal sac was still intact within the cervix; in the remaining two cases there was only a hemorrhagic, friable tumor present in the cervical canal, the true nature of which became evident only after microscopic examination. On clinical examination, the vaginal portion was in all cases spherically or pear-shaped distended, and grown to the size of an egg. Aside from the case of Fearl in which the placenta was moderately adherent, and from my own case, in which the complete and well preserved ovum could be removed without difficulty from the surrounding cervical wall, all other cases had the ovular tissue firmly anchored in the wall and could be separated from their bed only with great difficulty or not at all. The defect remaining in the cervical wall was each time like a crater, and was as impressive as the thinning of the cervical wall in the center of the placentation. On recalling the anatomical picture of the case we observed twenty years ago, two features stand out strikingly. The first was the presence of a canal lined with a pale mucosa proximally adjacent to the hemorrhagic bed of the ovum in the portio; the other, the perplexing fact that the examining finger within the cervical cavity and the palpating thumb within the vaginal fornix could almost touch each other, and were separated only by a paper-thin cervical wall. This thinning of the fibromuscular wall which would necessarily have led to a rupture into the vaginal fornix within a very short time, had pregnancy continued, has also been pointed out in other cases. For instance Stresow reported this thinning at the same site, and Gimpelson and Steinbiss on the posterior wall of the cervix, immediately before its rupture into the cul-de-sac. The trabecular structure at the base of the destroyed cervical wall has likewise been pointed out by some authors (Schneider, Steinbiss, Meyer).

3. *The case of Gergely* is a twelve-weeks old pregnancy, also exclusively situated in the vaginal portion of the cervix. The patient was seen eight days after she had suffered an injury (fall on coccyx). At that time the vaginal portion was enlarged to a fist-sized tumor. The anterior wall of the portio was of normal thickness, the posterior wall was thinned out to 2 to 3 mm. A tear, 9 cm. in length reached in the posterior cervical wall from the external os to the posterior vaginal fornix. The cavity of the ovum within the vaginal portion was separated from the cavity of the retroflexed uterine body by a canal passable by a Hegar probe No. 7.

4. *The cases of Szenteb and Meyer* are, in contrast to the preceding cases, characterized by the fact that the pregnancy was predominantly situated in the upper portion of the cervix. In the case of Szenteh it was a cervical pregnancy over eight weeks old, which on vaginal examination could be felt as a protrusion the size of a goose egg, to the right of and below the enlarged uterine body. The vaginal portion proper was apparently not involved. The pregnant cervix was ruptured into the abdominal cavity, the tear, 2 cm. long, taking place in the posterior wall. The case was examined histologically and it was reported that the whole fetal sac lay in the cervical canal. Only an abstract of the original paper was accessible to me, and this does not give any clues on the kind of determination of the upper boundary of the cervix. However, as a rupture of the cervix at so early a stage of pregnancy is not known, except in cervical implantations, and as all signs of the description speak in favor of a cervical pregnancy, this case should, to my mind, be recognized as a cervical implantation.

The second case of this group (case of Meyer) presents the furthest developed pregnancy in the upper part of the cervix, confined completely and exclusively to the cervix itself, as shown on histological investigation. This was a twelve-weeks old intact cervical pregnancy, in which the vaginal portion, though shortened, was preserved and continuous with an oval body corresponding in shape and consistency to a three months' gestation. Placed above this tumor, the uterine body could be palpated. As a result of a thorough microscopic examination of the extirpated organ, evidence was established to the effect that the placentation did not enter the isthmus. This proof of a placentation solely restricted to the cervix has not successfully been offered in any case of cervical placentation of more than three month's gestation.

5. Although the *case of Steinbiss* would fit into one of the above groups on account of its topography, it should be classified by itself because the clinical history was very indefinite. The ease was recognized as a cervical pregnancy only on postmortem, and then underwent a thorough anatomic-histologic work-up. There was a 4 to 3.5 cm. round, for the most part sharp-edged defect in the tissue of the posterior wall of the cervix, reaching in depth right down to the peritoneum, and seeming on the verge of rupture. Proximally the isthmus was included to a small extent in the placentation. This, however, was so insignificant in comparison with the defect in the cervix that the case can, without hesitation, be considered one of cervical implantation.

Histology. Histologic investigations on the early implantation of the ovum and its development within the cervical mucosa are completely lacking to date. This may be due to the fact that ova burrowing in the cervical mucosa superficially, are often destroyed (by hemorrhages into the ovum bed) and extruded as a whole. It is only when the villi, after penetration of the mucous membrane have invaded the musculature, that the ovum is attached more firmly and harder to separate. This would explain why ova up to the sixth week have not been observed, being expelled at an early stage with relatively insignificant and not characteristic symptoms.

The true cervical pregnancy shows all the characteristic signs of an ectopic gestation caused by the inability of the parent tissue to provide an adequate bed for the developing ovum. Like the mucosa of the tube, the cervical mucosa does not undergo definite gestational changes or decidual transformations. Occasionally, under the influence of gestational hormones, the formation of decidual cells may take place at the portio, in the presence of erosions, in cervical polyps and in the inflamed cervical mucosa. In the absence of inflammatory

signs, however, the appearance of decidual reaction in the cervix in the course of corporeal pregnancy seems to be rare. Stieve, who has done the most thorough investigations regarding the conditions in the cervix in normal pregnancy, reports that he never came across definite decidual cells in the cervix. However, like the tube, the cervical mucosa produces decidual cells, single and in larger groups, as an effect of hormonal and local reaction, once the ovum has embedded itself there. In no case of microscopically examined cervical pregnancy is the statement lacking that decidual cells were observed. Definite decidual reaction can be found in the immediate vicinity of the ovum, especially in the stroma at the peaks of the mucosal folds. (Figs. 1 and 2.) In my own case large plaques of decidual cells in units were found in the cervical mucosa at the periphery of the site of the placentation, while in the central parts, where the mucosa was mostly destroyed, no decidual cells could be seen. This reactive cell formation, produced through the presence of the ovum, can in no way be considered equal to the transformation of the endometrium into a true decidua graviditatis. Today it is generally thought that the thick decidual layer in the mucosa corporis first takes care of nourishing the ovum as long as it is in the histotrophic stage. The second important function of the corporeal decidua consists in building a protecting wall against the invading, tissue-dissolving, chorionic villi and mobile trophoblast cells, as soon as the second stage, the hemotrophic stage of feeding the ovum sets in. At this stage the chorionic villi absorb the nutritive elements from the maternal blood after erosion of the maternal vessels. The decidua basalis endometrii represents a regulating factor of the adequately functioning maternal tissue, checking the reckless, destroying advance of the villi. Through the production of an antitryptic enzyme a balance of powers is effected which prevents the invasion of the trophoblastic masses into the depth of the mucosa and musculature of the wall. As a consequence of the lack of this protective device in cervical pregnancy, the tissue surrounding the ovum is digested and destroyed without inhibition, exactly as in tubal pregnancy. In all cases examined, specifically with this point in mind, the deep penetration of the proliferating chorionic villi into the fibromuscular layer of the cervix could be established microscopically. We found the cervical wall infiltrated by large trophoblast cells, rich in protoplasm, partly in chains, partly isolated, particularly abundant around the vessels. Not their mere presence but their remarkably large number presents the pathognomonic status. Aprile sees the villi invading the blood vessels and the musculature. Otto observes the cervical musculature in the vicinity of the ovum bed strongly interspersed by chorionic villi and described young, well preserved chorionic villi within the lumen of the vessels of the cervical tissue. Steinbiss finds chorionic elements in all layers and villi implanting themselves deep in the musculature. The defect of the tissue thereby produced, already macroscopically very impressive, resembles the destruction of the tissue brought about by a malignant tumor, for which cervical pregnancy is occasionally mistaken. Neither with tubal pregnancy nor with placenta accreta do we come across such penetrating, circumscribed defects of tissue, confined to a relatively small area, as occurs in cervical pregnancy through the melting away of the thick cervical wall adjacent to the ovum. The vessels of the cervix show fibroid degeneration of their wall and infiltration by villi and trophoblast cells. The lumina of the vessels are considerably dilated and engorged with blood. The fibromuscular tissue of the cervix occasionally shows edema, swelling, fibroid degeneration, necrosis, hemorrhage, and small cell infiltration. With the tapping of larger vessels, especially with the erosion of arteries, the gestation sac gives way under the increased hemodynamic pressure and a flow occurs

through the external orifice towards the outside. Hemorrhages caused in this way can be found at an early stage in the clinical history of some patients. With further development of the ovum, its attachment to the ground of the implantation cavity becomes more intimate and the opening of large vessels is necessary to bring about the separation of the entire ovum. These large vessels are numerous in the deeper layer of the cervical wall. With their erosion, hematoma forms around the ovum and interruption of pregnancy by abortion takes place (internal rupture of the gestation sac). The second possible ending of cervical pregnancy is that the wall destroying growth of the chorion towards the periphery leads to a complete consumption of the ovum bed and to a perforation of gestation towards the outside (external rupture of the gestation sac, cervical rupture). Of the twelve cases of cervical pregnancy mentioned, four were intact at the time of their observation, five terminated by internal, and three by external rupture of the gestation sac.

Decidua Sympathica. The uterine mucosa in cervical pregnancy reacts to the presence of a live ovum with the formation of a decidua sympathica, as it nearly always does in ectopic pregnancy. But we find only in six cases microscopical examinations carried out in this respect. In four cases a typical decidua was present. In the remaining two cases none was found, explained by the fact that between termination of the pregnancy and the histological examination of the specimen, two and four weeks, respectively, had elapsed.

Clinical Symptoms. In search of charteristic symptoms of cervical pregnancy before the occurrence of severe hemorrhage, it must again be emphasized that clinical records are still more scarce than anatomical data. Regarding preceding gestations all possibilities are presented in the cases of cervical pregnancies. With most women one or more pregnancies had preceded, some of which had terminated with a spontaneous abortion and some with a delivery in term. Only in one case (Meyer) the present pregnancy was the first. Some women complained of pain in the lower abdomen or back, while in some cases the first weeks of pregnancy were symptomless. Most frequently one comes across statements of irregular bleedings after cessation of the menstruation; for example in the case of Aprile, hemorrhages occurred fourteen days after the skipped menstruation. Irregular, slight hemorrhages starting in a later stage were frequently observed. In my own case, cyclic menstrual bleedings continued in no connection with bleedings from the ovum bed. In the end, it was always the violent hemorrhages following the complete separation of the ovum or the rupture of the cervical wall which led to medical intervention.

Diagnosis. Of special interest is the variety of diagnoses which were made before knwoledge of the true facts of the cases. If the pregnancy in the vaginal portion of the cervix happened to be observed at a time at which the ovum was not yet separated from its surrounding, then the right diagnosis of cervical pregnancy was made (Gimpelson, Stresow). If, however, the case was examined after separation of the ovum, but still during its retention within the cervix, then the first impression was that of a cervical abortion (Schneider, Aprile). If on thorough examination a violently bleeding, crater-like defect was found in the cervical wall, the retained hemorrhagic ovular remnants were not recognized as such, and the obvious diagnosis was malignant, cervical tumor (Aprile, Gheorgiu, Frachtman). The pregnancy that ruptured through the anterior cervical lip was first referred to the hospital as a bleeding varicose vein of the portio (Otto). In the hospital the diagnosis changed to that of a cervical metastasis of a chorion epithelioma, and the uterine cavity was searched for the primary source of this disease. The rupture of the cervical pregnancy into the abdominal cavity was misinterpreted as ruptured tubal pregnancy (Szenteh). A blood mole, attached all around the cervical wall in

the course of cervical pregnancy, aroused the impression of a necrotic fibroid (Gheorgiu). In the patient of Steinbiss who died of a secondary hemorrhage four weeks after completed abortion, an autopsy was performed in an institute for Forensic Medicine, because of suspected criminal abortion, and not until then was the right diagnosis of cervical pregnancy made. The case exposes the occasional forensic significance of distal ectopic pregnancy.

Differential Diagnosis. In consequence of the multiformity in which the cervical pregnancy may appear, no generally valid rules for diagnosis can be given. One is easily misled to take a cervical pregnancy for an abortion of a corporeal pregnancy into the cervix, which it resembles to a certain degree on digital exploration. In the differential diagnosis of a cervical pregnancy versus a cervical abortion, one has to keep in mind that in the case of an abortion from the uterine cavity into the cervix, violent, painful uterine cramps and hemorrhages preceded the complete separation of the ovum. At the time when the abortion is essentially over, but the external os has not opened and a contracted body can be felt above the dilated cervix, no essential hemorrhages or pains are present. On the other hand no uterine cramps accompany cervical pregnancy, and hemorrhage is increased by digital examination, or brought about by it for the first time. While in cervical abortion the elastic pressure of the dilated cervical wall has the tendency to expel the retained ovum through the external orifice, in cervical pregnancy no such tendencies exist, in consequence of the severe damage to the fibromuscular wall of the cervix. Beyond that the ovum is mostly held tight within the cervical canal by the chorionic villi deeply anchored within the wall.

Hemorrhage. Whether a cervical pregnancy terminates spontaneously, be it by rupture of the extremely thinned cervical wall, be it by internal rupture of the gestation sac (abortion), or whether it is interrupted artificially, the leading, and most alarming symptom is always the violent hemorrhage associated with it. While the blocd supply of the non-pregnant cervix is already abundant, in normal corporeal pregnancy a considerable increase in size and a new formation of vessels in the cervix takes place at an early stage, as Stieve has demonstrated. The presence of the growing ovum and the development of the placenta in the cervix naturally causes a strong local hyperemia. The inability of the maternal tissue to resist the villi leads to an uninhibited and reckless opening of the blood vessels. The direct insertion of the placenta into the muscularis, without interposed mucous membrane, results in an unphysiological and inadequate separation mechanism of the placenta, typical of ectopic gestation and of placenta accreta. The lack of a physiological vascular occlusion, as consequence of the damaged and defective musculature of the cervical wall, the fibrinoid degeneration of the vascular wall and the loss of elastic elements in the vessels associated therewith, favor in every imaginable respect a violent, acute and life-endangering hemorrhage in the moment of rupture of the gestation sac. The same factors are to be made responsible for the defective thrombus formation in the vessels, which, in some cases can lead to severe hemorrhages weeks after expulsion of the ovum (Schneider, Gimpelson) and even to fatal secondary hemorrhage (Steinbiss).

Therapy and Result. The spontaneous rupture of a cervical pregnancy through the anterior cervical lip (Otto) was cured by amputation of the cervix, and the spontaneous rupture into the pouch of Douglas (Szenteh) was successfully treated by a supracervical amputation of the uterus. In the case of Gergely the extremely thinned and dilated posterior wall of the portio ruptured after the patient had fallen on her coccyx. The hematoma that consequently developed was only removed eight days after this mishap and hemostasis was achieved by tight packing of the cervix. The patient

died fourteen days later of an ascending peritonitis. In the case of Meyer, (the three months old pregnancy in the upper portion of the cervix) sectio parva was attempted for the purpose of artificial interruption of the pregnancy. The hemorrhage in the course of operation could not be stopped by packing or by clamps. Only by extirpation of the uterus, leaving the lowest portion of the cervix, could the hemorrhage be checked and the patient cured. In all other cases a violent hemorrhage took place during or immediately after removal of the ovum or of the remaining fragments of the ovum, which, in the case of Gheorgiu necessitated the extirpation of the uterus. In the remaining cases the hemorrhage could be stopped by packing and ligatures, sometimes only after repetition of the packing during the following days. In the cases of Schneider and Gimpelson, life-endangering secondary hemorrhage occurred after two weeks caused by detachment of the vascular thrombi, which in my own case could be cured by packing, and in the case of Gimpelson through extirpation of the uterus. Only in one case, not under medical care (Steinbiss) a fatal secondary hemorrhage from eroded vessels of the site of placentation, occurred four weeks after spontaneous abortion.

Etiology. The same consideration with regard to the etiology of cervical pregnancy taken into account twenty years ago, can still be brought forth today. Between fertilization of the ovum and its implanting, several days elapse, during which the ovum passes through the so-called maturation for implantation; only at the end of this period is the ovum capable of penetrating into the maternal tissue as a result of the development of its invasive powers. This implantation term depends on a certain degree of differentiation of the ovum. The maturing process takes place mainly during the downward passage of the ovum through the tube. The presumed time of this process is seven to ten days.

The site of implantation is determined by two principal factors: the tempo of the travel of the ovum and the duration for the ripening for implantation. Under normal conditions, free traveling of the ovum and maturing process for implantation are synchronized in such a way that at the time the ovum has gained its implantation maturity, it is located exactly in the uterine body. If a shifting of either of these factors against the other takes place, it results in a pathological nidation. If the transport of the fertilized ovum is delayed or suspended by obstacles within the course of the ovum, the pathologically proximal insertion of the ovum takes place. The same is bound to happen on normal passage but too early onset of implantation maturity. If, however, the travel of the ovum is accelerated and the implantation maturity normal, or if the traveling time is normal but the maturation delayed, the prerequisites for a pathologically distal insertion of the ovum are present. The implantation maturity is a function of the ovum; the travel of the ovum is a function of its environment. One may assume that the implantation maturity is subjected only to a narrow range of variation as it is a biologically and phylogenetically deeply rooted process. The transportation of the ovum on the other hand, secured by the peristalsis of the tube, the contractions of the uterus and the ciliary current of the epithelium of the mucosa is more subjected to variations. How often a defect of these functions or an obstruction of the tube leads to a proximal ectopic pregnancy is well known. Excess in the other direction, i.e., too rapid transportation of the ovum leads to a pathologically distal implantation of the ovum.

The ovum is, so to speak, not discriminative in the choice of its implantation ground. Having gained the adequate invasive power at the time of implantation maturity, it implants itself on the surface of the mesenterium as well as on the serosa of the uterus, on the ovary as well as in the tube and cervical mucosa. While for the occurrence of a pathologically

proximal insertion of the ovum, conditions impairing its transport form the most frequent cause, for the causation of a pathologically distal pregnancy, especially a distal ectopic, the possibility must be left open that the ovum becomes caught by a delayed implantation maturity occurring in an explosion-like manner in the last moment just before its extrusion from the uterus.

CONCLUSION

Herewith an attempt has been made for the first time, to put together the anatomical and clinical data of distal ectopic pregnancy on the basis of a relatively small and inadequately described number of cervical pregnancies as given in the world literature. Particularly in Anglo-American literature, only one case of cervical pregnancy can be found published recently by Fearl. The present case observed by Frachtmann is the second of its kind in American literature definitely proven as cervical implantation. It would be extremely desirable to have cervical pregnancies recognized in their early stage and the diagnosis supported by thorough anatomic-histological investigation. Our knowledge of this rare and interesting gestation type, almost always associated with violent symptoms, would, thereby, be put on a broader basis.

REFERENCES

1. Ahlfeld and Aschoff. Beitrag zur Genese der Placenta praevia. *Ztschr. f. Geburtsh. u. Gynäk.*, 51: 544, 1904.
2. Andrei, O. Rapporti tra gravidanza cervicale primitiva e corionepitelioma. *Ann. di ostet. e ginec.*, 54: 315–334, 1932.
3. Bacialli, L. Ancora sulla gravidanza cervicale. *Riv. Ital. di ginec.*, 6: 362–364, 1927.
4. Bolaffi. Considerazioni cliniche su due casi di gravidanza cervicale. *Arch. di ostet. e ginec.*, 19: 657–663, 1932.
5. Crousse, R. Cervical pregnancy followed by death from hemorrhage in course of abortion. *Bruxelles med.* 14: 379, 1934.
6. Davis. Gynecology and Obstetrics. Hagerstown, 1934.
7. d'Aprile, F. Un caso di gravidanza cervicale. *Clin. ostet.*, 39: 14–19, 1937.
8. De Michele, R. Un caso di gravidanza cervicale. *Arte ostet.*, 41: 29–40, 1928.
9. Desirotte. Un cas de grossesse cervicale. *Bruxelles med.*, 20: 802–803, 1940.
10. Clifford L. Fearl. Cervical pregnancy. *West. J. Surg., Obst. & Gynec.*, 53: 71–72, 1945.
11. Gänssbauer, H. Ein Fall von Cervicalschwangerschaft. *Zentralbl. f. Gynäk.*, 51: 1393–1398, 1927.
12. Gergely, György. Spontane Cervixruptur mit tödlichem Ausgang. *Zentralbl. f. Gynäk.*, 59: 1111–1113, 1935.
13. Gheorghiu, N. and Protopopescu-Pake, I. Primäre Cervixschwangerschaft. *Rev. Obst.*, 4: 1935.
14. Gimpelson, D. Cervicalgravidität, *Akus. i. Ginek.*, 4: 461, 1936.
15. Hyslop, D. Case of cervical pregnancy. *Brit. M. J.*, 2: 1256, 1935.
16. Jolkin, M. Ein Fall von Cervicalschwangerschaft. *Zentralbl. f. Gynäk.*, 50: 3071, 1926.
17. Kleiner, B. Zur Frage der Cervicalgravidität, Ein Fall einer jungen Placenta isthmico-cervicalis. *Monatschr. f. Geburtsch. u. Gynäk.*, 83: 291–303, 1929.
18. Meyer, J. Cervical pregnancy case. *Finska läksällsk. handl.*, 71: 177, 1929.
19. Mueller, E. A. De Implantatione Ovuli Isthmico-Cervicali. Inaug. Diss. Kiel, 1924.
20. Otto. Seltener Sitz einer Schwangerschaft im unteren Abschnitt der Cervix. *Zentralbl. f. Gynäk.*, 58: 2204, 1934.
21. Pankow, O. Halban-Seitz, Biologie und Pathologie des Weibes, Placenta praevia. VIII: 18, 1927. Urban & Schwarzenberg.
22. Reist, Seltene Schwangerschaftsectopie in Form einter Graviditas cervicalis primaria. *Monatschr. f. Geburtsch. u. Gynäk.*, 65: 112, 1941.
23. Schmidt, H. R. Anatomische Untersuchungen zur Frage des unteren Uterinsegmentes. *Ztschr. f. Geburtsch. u. Gynäk.*, 85: 233, 1922.
24. Schneider, P. Gravidität in der Portio vaginalis cervicis uteri. *Arch. f. Gynäk.*, 129: 382–399, 1926.
25. Schürger, A. Über Cervicalschwangerschaft. *Zentralbl. f. Gynäk.*, 61: 2584–2588, 1937.
26. Steinbiss, W. Tod infolge einer Placenta cervicalis accreta unter falschem Verdacht auf kriminellem Abortus. *Deutsche. Ztschr. f. gerichtl. Med.*, 12: 234–240, 1928.
27. Stieve, H. Der Halsteil der menschlichen Gebärmutter, seine Veränderungen während der Schwangerschaft, der Geburt und des Wochenbettes und ihre Bedeutung. *Jabrbuch f. Morph. u mikrosk. Anat.*, 11: 300, 1927.
28. Stresoff, K. I. Cases of cervical pregnancy. *Odessky M. J.*, 2: 43, 1927.
29. Studdiford, W. E. Cervical pregnancy. *Am. J. Obst. & Gynec.*, 49: 169, 1945.
30. Szenteh, St. Schwere Bluntung in die Bauchhöhle bei cervicaler Schwangerschaft mit Cervixruptur. *Magyor Nögyogyszat.*, 2: 233, 1933.
31. Tarleton, L. Cervical pregnancy. *Brit. M. J.*, 2: 569, 1934.
32. Tropea, U. Contributo alla conoscenza della gravidanza cervicale. *Rassegna d'ostet. e ginec.*, 38: 93, 1929.
33. Vaudescal, R. De la grossesse cervical. Lecons du jeudisoir, 118, 1931.
34. Wittrin, E. Uber cervicale Schwangerschaft. *Zentralbl. f. Gynäk.*, 62: 346, 1938.

A COMPARISON OF SILK AND NYLON AS SUTURE MATERIAL

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SURGICAL literature is replete with articles concerning various types of materials used for sutures and ligatures. Since the detailed description of the "silk technic" by Halsted[1] in 1913, there has been constant controversy regarding the relative advantages and disdavantages of absorbable versus non-absorbable suture materials. Until some ideal material is discovered, having the absorbability of catgut sutures, and the relatively low tissue reaction of non-absorbable sutures, each of these materials will continue to have its exponents.

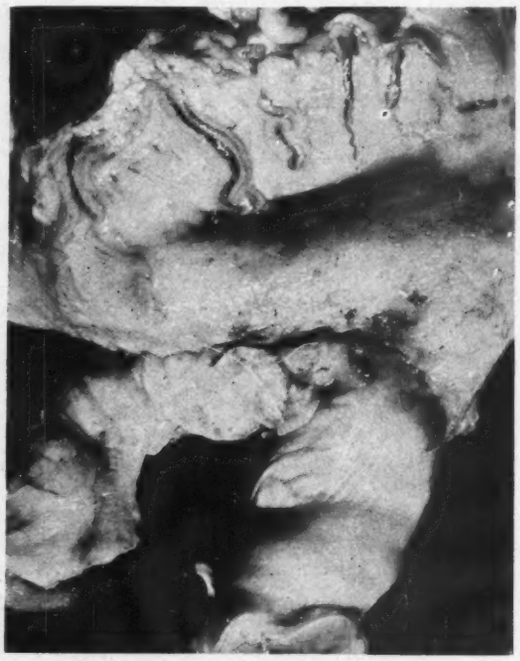

FIG. 1. Gastrointestinal anastomosis performed with nylon, forty-eight hours postoperatively.

With the introduction of nylon, a synthetic product, there was presented a substitute for silk, for which various advantages were claimed: (1) greater tensile strength; (2) greater elasticity; (3) more constant uniformity in diameter; (4) smoother surface; and (5) less reaction in tissues.

The results of several investigations have been reported using nylon in skin, muscle and fascia.[2]

The present study is concerned with a comparison of silk versus nylon as suture material in intestinal anastomosis, and with an evaluation of the safety in the use of nylon.

EXPERIMENTS

Procedure. The experimental procedures were carried out on eight healthy dogs. These were divided into two groups with four animals in each group. The usual aseptic operating room technic was employed. Nylon was used in Group I, and silk in Group II.

Each material was used in performing a two-layer gastroenterostomy. A moisture and serum-proof braided nylon suture, measuring 0.006 inches in diameter,* was used in Group I. This corresponds to a No. 0000 catgut suture. A similar braided silk suture,** of the same diameter as the nylon, was used in Group II. Correspondingly heavier grades of the same materials were

* #C Deknatel surgical nylon suture.
** #C Deknatel surgical silk suture.

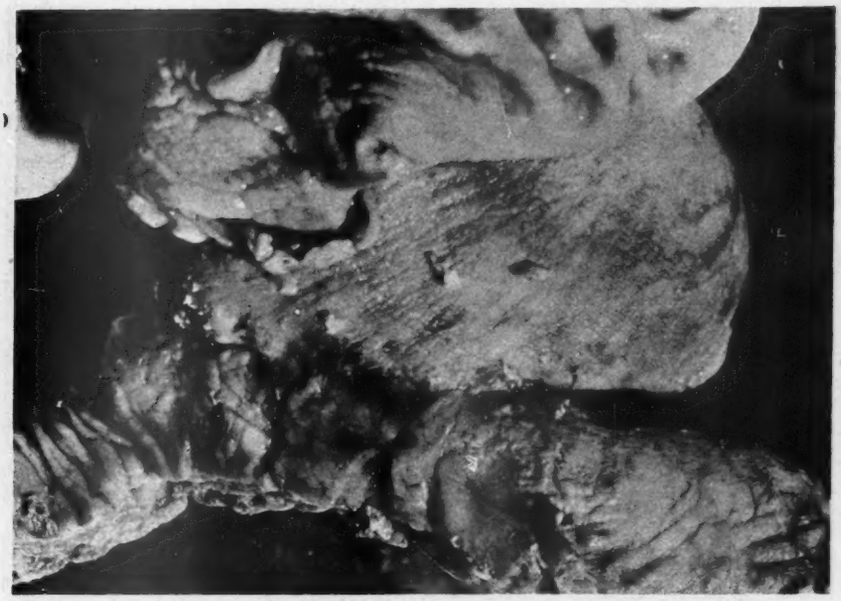

Fig. 2. Gastrointestinal anastomosis performed with silk, forty-eight hours postoperatively.

used in closing the peritoneum, fascia, muscle and skin.

Post operatively, the animals were treated symptomatically and were given the usual parenteral fluids. After forty-eight hours they were offered a soft diet, and then other foods were given as tolerated. The animals were sacrificed at different intervals postoperatively, namely, forty-eight hours, ninety-six hours, nine days and thirty days. The organs were examined grossly and sections were taken from various regions of the anastomoses for microscopic studies.

Findings. Operative: It was found that nylon, whether wet or dry, seemed to maintain its body texture better than did silk. It handled more easily and was less likely to break during the process of tying. The postoperative course of the animals was uneventful, with no apparent discomfort or rise in temperature beyond the usual expectations.

Postmortem. On gross examination of the anastomosis, peritoneum, fascia, muscle and skin in each of the animals, there was no significant difference that could be attributed to the type of material employed. The anastomotic stoma were intact in all animals. Those autopsied at forty-eight and ninety-six hours showed a mild degree of serosal congestion with occasional slight ecchymotic areas, attributable to the relatively recent operative manipulation.

Fig. 3. Stoma of gastrointestinal anastomosis performed with nylon, ninety-six hours postoperatively.

(Figs. 1 and 2.) The intact, well healed stoma of the ninety-six hour nylon anastomosis is shown in Figure 3. Those animals which were examined after nine days and thirty days showed well healed anastomoses. (Figs. 4, 5, and 6.)

FIG. 4. Gastrointestinal anastomosis performed with nylon, nine days postoperatively.

The microscopic findings of* the anastomoses with both silk and nylon were as follows: "Sections through the anastomoses show suture material in both the submucosal and muscular layers of the gastrointestinal wall. In view of the fact that many of the sectioned strands of suture were lost in the process of preparation of the slides, the sutures are represented by only a few persistent strands of material, with an adjoining clear area, the latter representing the previous site of the lost fragments. Directly surrounding the clear zone there is the zone of reaction. In the 48-hour and 96-hour nylon specimens, there is a typical early foreign body reaction, with a moderate infiltrate of polymorphonuclear leucocytes and occasional round cells. The silk specimens of the same

FIG. 5. Stoma of gastrointestinal anastomosis performed with nylon, nine days postoperatively.

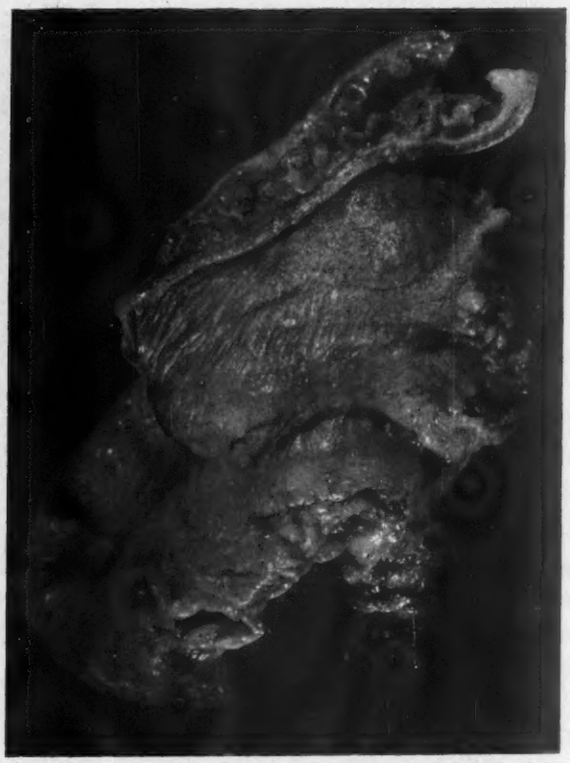

FIG. 6. Gastrointestinal anastomosis performed with nylon, thirty days postoperatively.

* Reported by Dr. S. H. Polayes, Department of Pathology, Cumberland Hospital, Brooklyn, N.Y.

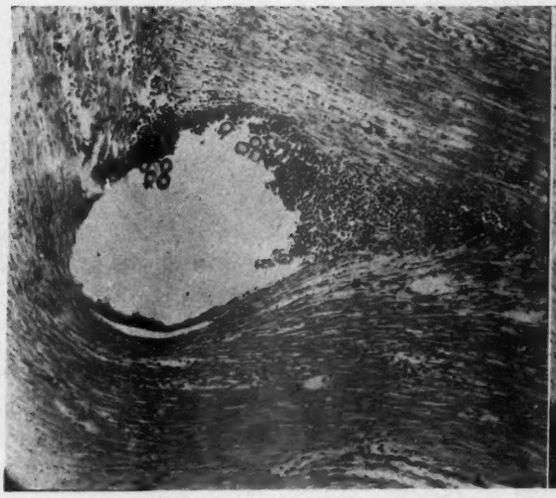

Fig. 7. Section through intestinal anastomosis, showing nylon suture in place with early polymorphonuclear leucocytic response, forty-eight hours postoperatively.

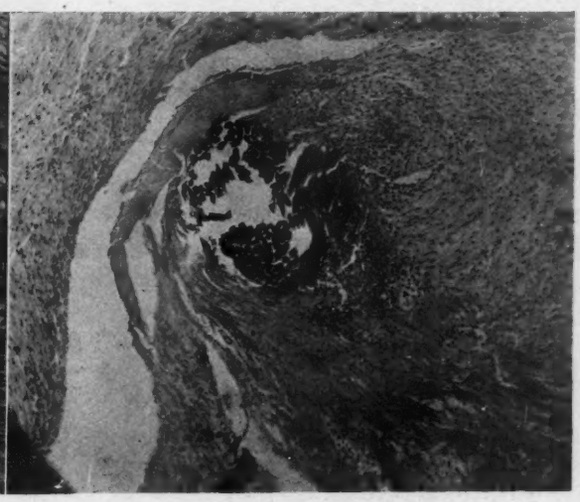

Fig. 8. Section through intestinal anastomosis, showing silk suture in place with early polymorphonuclear leucocytic response, forty-eight hours postoperatively.

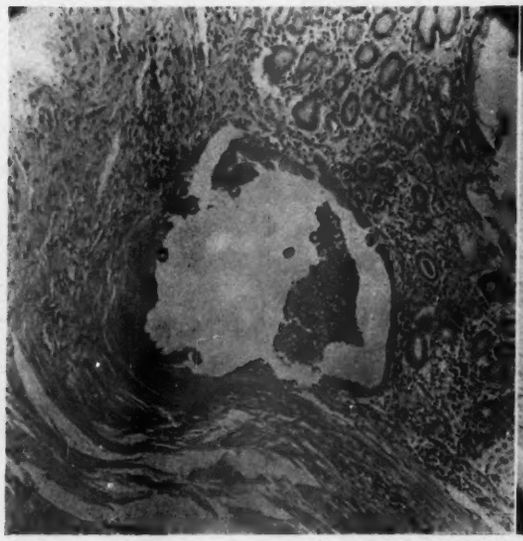

Fig. 9. Section through intestinal anastomosis showing nylon suture in place with subsiding acute cellular response and beginning round cell infiltrate, ninety-six hours postoperatively.

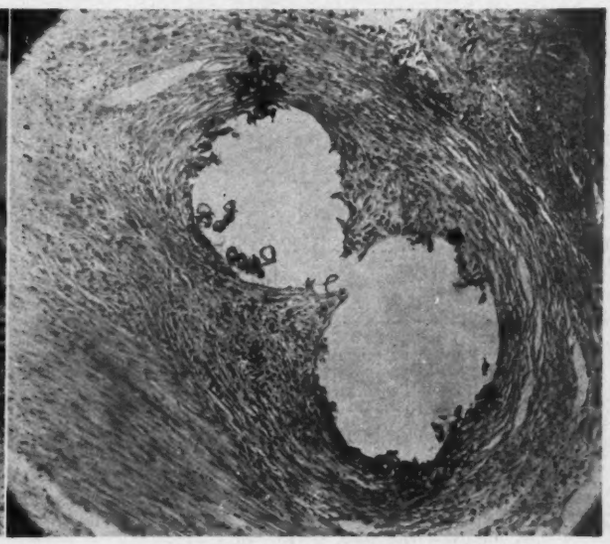

Fig. 10. Section through intestinal anastomosis showing nylon suture in place with typical foreign body reaction in later stage with foreign body giant cell formation and early encapsulation of suture by fibrous connective tissue, nine days postoperatively.

intervals show a similar reaction. There is no discernible qualitative or quantitative difference in the degree of reaction to either of the materials used. (Figs. 7, 8, and 9.) The latter specimens, namely, 9 days and 30 days, show changes characteristic of foreign body reaction in its later stages. There is replacement of the polymorphonuclear cells by round cells and plasma cells. The oldest specimens show beginning giant cell formation, with an attempt at encapsulation of the suture by fibroblastic tissue reaction. (Fig. 10.) In these latter specimens as well, there is no discernible qualitative or quantitative differences between the reactions to silk and to nylon."

Conclusions. On the basis of this experiment, one may conclude that: (1) Nylon may be used as a substitute for silk or catgut in gastrointestinal anastomoses; and (2) nylon produces approximately the same degree of tissue reaction as does silk.

COMMENTS

Why substitute nylon for silk? Assuming that both are readily available and the costs of these materials are comparable, it was decided to determine whether there are any practical advantages of nylon over silk. The following physical properties of both these materials were then studied and compared: (1) surface smoothness, (2) tensile strength, and (3) elasticity, or degree of elongation.

Surface Smoothness. Microscopic examinations were made of both silk and nylon sutures. These revealed silk to have minute hair-like projections extending from its surface, whereas nylon was perfectly smooth.

Tensile Strength. This was determined by suspending the material to be tested between two jaws which were then pulled apart at the rate of 12 inches per minute. The tensile strength (breaking load) was read at the point of rupture of the material. Silk and nylon of various diameters were tested in the above manner, with the following results:

Suture No.	Diameter (inches)	Tensile strength (pounds)		Difference Per Cent
		Silk	Nylon	
C	0.006	1.23	1.65	34
2	0.014	6.90	6.22	10
5	0.023	15.98	16.65	4
6	0.028	19.20	24.90	29
8	0.033	27.80	31.83	14

Note that No. 2 silk had a greater tensile strength, but in all the other diameters nylon was the stronger.

Elasticity or Degree of Elongation. Probably more important than tensile strength is the elasticity, or degree of elongation, of a suture before it breaks. Assuming a suture has a tensile strength of 10 pounds, it will then break when this pull is exerted upon it; however, before breaking, it will stretch to its end point of elongation. In tying a knot, the surgeon exerts a certain pull in tightening it. If the pull is greater than the tensile strength of the suture, the suture will break only, however, after being fully elongated. Thus, the elongation of a suture acts as a safety factor in preventing it from breaking. The greater the degree of elongation, the less the likelihood of the suture breaking. Elongation tests were performed to compare silk and nylon. The degree of elongation before breaking was determined. These tests were performed in a manner similar to that used in determining the tensile strength with the following results:

Suture No.	Diameter (inches)	Elongation (Elasticity)		Difference Per Cent
		Silk Per Cent	Nylon Per Cent	
C	0.006	25	19	30
2	0.014	15	19	27
5	0.023	16.5	23.5	42
6	0.028	23.75	30.0	22
8	0.033	24.2	27.45	13

Note that except for suture size No. C, nylon shows greater elasticity than silk in all of the sizes tested.

CONCLUSIONS

1. Nylon may be used with safety as a substitute for silk in gastrointestinal anastomoses.
2. Nylon produces approximately the same degree of tissue reaction as does silk in intestinal anastomoses.
3. Nylon has a smoother surface than silk.
4. Nylon has greater tensile strength and greater elasticity than silk in most thicknesses.*

REFERENCES

1. Halstead, W. S. Ligature and suture material. *J. A. M. A.*, 60: 1119–1126, 1913.
2. Nichols, H. M. and Diack, A. W. Experimental study of nylon as suture material; preliminary report. *West. J. Surg.*, 48: 42–46, 1940.

* The tests for tensile strength and elongation were performed by the United States Testing Co., Inc.

MANAGEMENT OF SHARP POINTED FOREIGN BODIES IN THE GASTROINTESTINAL TRACT*

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OMAHA, NEBRASKA

THE history of an individual having swallowed one or more sharp-pointed foreign bodies and the portrayal of these foreign bodies by *x*-ray examination usually bring some consternation to the attending physician or surgeon. As a rule those who have had the greatest experience in the management of such cases advocate careful observation and non-surgical treatment while those with only an isolated experience tend to favor surgical interference. There is no doubt that a sharp-pointed foreign body, and especially such complicated structures as an open safety pin, is a potential hazard for bowel perforation. An experience in which twelve young adults in a period of six weeks swallowed foreign bodies in an attempt to shirk their strenuous duties in a disciplinary training center seems worthy of relating. To have hospitalized these individuals and performed abdominal operations with a short or prolonged period of convalescence would only have been acceding to their wishes as it would have given them some respite from their strenuous assignment.

There are certain inherent dangers from a sharp-pointed foreign body passing along the gastrointestinal tube and maneuvering its way through the narrow passageways of the pylorus, duodenojejunal junction, ileocecal valve, colon flexures and sigmoid areas; and some anxiety is experienced by the attending surgeon who realizes that simple gastrotomy, ileotomy or colotomy with modern surgical technic carries very few dangers. In private practice, the expense of hospitalization and operation is an economic factor; but in the management of men from disciplinary training centers in the military service or penal institutions of civilian life, it is desirable that such individuals do not escape arduous tasks or confinement for the special comforts of hospitalization by their overt acts. If escape for several individuals is accomplished, such a practice may assume epidemic form and therefore conservative management without hospitalization is most desirable.

The mechanism of sharp-pointed instruments passing through the velvety mucosal-lined gastrointestinal tube without penetrating and perforating the tubal wall is based on the factor of bowel wall trigger reaction, resulting in a firm contraction of the muscular wall which rejects the foreign body in most instances, provided no firm solid wall is backing up the other end of the sharp object. Rarely are the intestinal contents sufficiently firm to prevent backward dislodgment as the stimulated segment contracts, and the firm contracting wall makes it more difficult for the point to pierce the intestine. Again, if the point of the foreign body escapes contact with the wall and is directed into the lumen, the advancing ring of inhibition permits easy progress along the intestinal tract. In our experience, sharp-pointed objects always made slower progress traversing the intestinal canal, which is probably based on the premise that when the point contacts the intestinal wall and sets up repeated contraction rings, retardation in passage is the result. Ordinary sewing needles, with both ends quite sharp, were slower in passage than the larger, closed safety pin. The larger single pointed nail passed more rapidly than the sewing needle but slower than the closed safety

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FIG. 1. Open safety pin in lower sigmoid, passed without incident.

FIG. 2. Open safety pin in descending colon, passed without incident.

pin. Naturally, other factors do enter into the rapidity of travel, such as the thickness or length of the object and individual intestinal activity. Our observations and data show that after the foreign body travels beyond the splenic flexure, its passage through the descending colon and sigmoid is rather rapid. The fecal consistency as well as gravity may play a part in this progress. The exit of these sharp pointed bodies through the anal canal is most remarkable as no patient in this series complained of annoying distress as the object was being expelled. Following are individual case reports and remarks.

CASE REPORT

CASE I. D. S. T. In this first case observed by us, the soldier prisoner claimed that he had accidentally swallowed a straight sewing needle while repairing his clothing. He was seen about twenty-four hours following this incident and *x*-rays revealed a sewing needle in the small intestine. He was kept in the hospital about fifteen days before *x*-rays proved the complete passage and exit of the needle.

CASE II. N. N. This patient arrived a few days before the first man was discharged from the hospital. He might be considered a veteran at deliberately swallowing foreign bodies as he had had a previous experience elsewhere five months before. The knowledge that his colleague was receiving satisfactory hospitalization at a hospital temporarily assigned to receive patients from the center probably encouraged him in his second offense. At his first experience he had been operated upon and a safety pin was removed from his stomach. This soldier arrived at our hospital about twenty-four hours after swallowing another safety pin. *X*-rays revealed an open safety pin in the jejunum and because of the pain of which he complained and the apparent abdominal wall rigidity, operation seemed advisable. Upon opening the abdomen it was found that the point of the pin had penetrated the intestinal wall and was just beneath the serosal layer. An attempt to close the pin or manipulate it along the jejunum gave one the impression that it was snagged in the wall of the jejunum. An attempt at backward displacement resulted in a twisting or turning of the pin and the point appeared through the serosa of the intestine. The jejunal wall was then incised and the safety pin removed without further incident. Although this was only the second case in our series, the repetition of this individual's attempt made us alert to the possibility of a deliberate act and he was transferred back to the stockade in about one week.

CASE III. A. R. B. This patient had been *x*-rayed at another hospital two months previously for having swallowed a nail. He claimed

Fig. 3. Open safety pin on right side and a closed safety pin on left side. The closed safety pin appeared to make much more rapid progress.

Fig. 4. A ten-penny nail and portion of a safety razor blade in the transverse colon. No difficulty was experienced.

that he saw the nail in the picture and that he was dismissed from the hospital in a few days without operation. He was *x*-rayed at our hospital because of the history of this previously swallowed foreign body and the complaint of abdominal distress. There was no evidence of a remaining nail. About ten days later he reentered our hospital, stating he had accidentally swallowed a safety pin. *X*-ray revealed an open safety pin. Because of continued distress (probably not present), he was operated upon and an open safety pin was removed from the cecum. Attempts to close the pin within the lumen of the colon were unsuccessful because of its very strong spring action. This third case in about three weeks substantiated our impression that these acts were deliberate and that there would be other cases in the future.

Case iv. W. T. B. Two days after the admission of Case iii, another soldier from the same stockade was admitted to the hospital, claiming that he had accidentally swallowed two needles while sewing. *X*-ray revealed two needles, one in the small intestine and one in the large intestine. The following day the *x*-ray study was repeated and only one needle remained, it now being in the rectum. The patient was immediately returned to the stockade without further incident.

Case v. F. P. B. On the same day that Case iv was admitted, another soldier prisoner entered the hospital claiming that he had accidentally swallowed a staple six months previously. Unfortunately, his intelligence level was so low that he had forgotten he had been in this same hospital one week before because of a backache and that anteroposterior and lateral films of the spine had been taken. These *x*-rays revealed no foreign body. *X*-rays taken on his second admission to the hospital revealed a rather large staple in the sigmoid. He was returned to the stockade without operation. Two days later an *x*-ray revealed no evidence of the staple. There was no doubt that he had prevaricated regarding the time when he swallowed the staple.

Case vi. V. S. On the following day, another soldier was admitted from the stockade, claiming that on the previous day he had accidentally swallowed two safety pins. *X*-ray revealed one open safety pin near the hepatic flexure and a closed pin in the region of the descending colon. On the following day, *x*-ray study revealed that both pins had been expelled from the colon.

Case vii. L. A. R. The same day that Case vi was admitted, this soldier was brought to the hospital with the story that he had swallowed a safety pin two days previously. *X*-ray revealed a closed safety pin in the rectum and he was promptly returned to the stockade.

Case viii. J. H. Several days later, another soldier was admitted from the stockade. *X*-ray revealed an open safety pin in the transverse colon and a closed safety pin in the sigmoid. The closed pin passed the next day but the open pin was somewhat slower in its journey through the sigmoid. Four days later it had been expelled without incident.

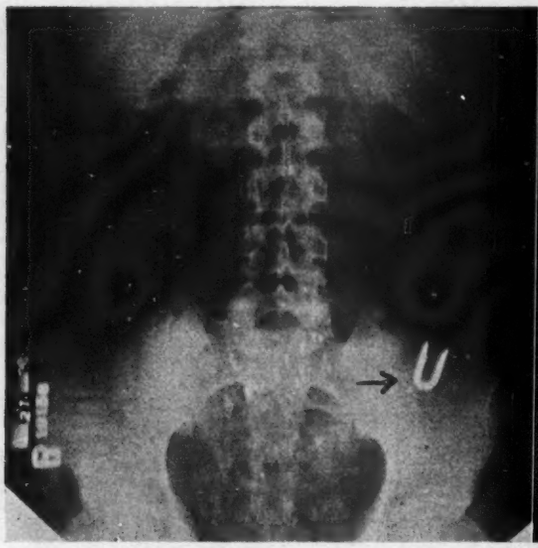

FIG. 5. A rather large staple descending through the sigmoid; passed without incident.

FIG. 6. A coil of barbed wire which traversed the intestinal tract.

CASE IX. J. D. Several days later this patient was admitted from the same disciplinary training center. He was *x*-rayed and a nail, a piece of twisted wire and portions of a razor blade were identified in the intestinal tract. Their progress was followed and five days later they were no longer seen on the *x*-ray films. He was told that he would be discharged that evening. Then he proceeded to swallow four straight pins which he had concealed. He was discharged in spite of this act. Two days later he was returned to the hospital for *x*-ray study and the film revealed that he had added a closed safety pin to the collection. All of these were passed without further hospitalization or incident.

CASE X. N. J. The following day, another soldier was brought into the hospital stating that he had swallowed a number of pieces of glass. This was authenticated by several other prisoners. There was nothing to be seen on the *x*-ray film and he was returned to the disciplinary training center without incident.

CASE XI. F. G. This prisoner claimed that he had swallowed a nail five days previously. He was checked by *x*-ray and the films were negative for a foreign body. He regretted that he had swallowed it and feared reporting the matter but his greater fear of the consequences forced him finally to seek medical advice.

CASE XII. G. P. This prisoner soldier from the same disciplinary training center was *x*-rayed on the day he stated that he had swallowed a piece of barbed wire. The wire was visible on the film but the patient was returned to the stockade. Three days later he swallowed a staple and two pieces of wire. By this time we had initiated the plan of having fellow prisoners guilty of the same act search their own stools or the other prisoners' stools for the foreign bodies. All of these foreign bodies were recovered from the stool in this case. Soon after this plan of stool searching was initiated, the epidemic came to an end.

Foreign bodies reach the gastrointestinal tract as a result of accidental or intentional means. Those classified as intentional occur in individuals who are side show freaks, are in an abnormal mental state, have suicidal tendencies, or are escapees, prisoners of various types desiring to escape punishment or work by creating a need for hospitalization and operation. In individuals who have swallowed foreign bodies, whether children or adults, alarm is caused by the story or history rather than symptoms. In two of these twelve cases, operation seemed indicated and was successfully performed. However, after our six weeks' experience with this group of individuals and review of the cases, we are inclined to believe that in one of these cases—the second case—we were misled by the patient's shrewdness in establishing a picture which simulated early perforation.

The usual treatment for sharp-pointed bodies which have been swallowed and have passed into the stomach or intestines is watchful waiting with careful observation and repeated fluoroscopic or *x*-ray examination. Only occasionally will operation be indicated. Bowel penetration or perforation evidenced by abdominal tenderness, muscle rigidity, changes in pulse, temperature and blood count would be an indication for abdominal exploration. If the sharp-pointed foreign body remains stationary for over twenty-four hours after leaving the stomach, very detailed observation of the patient is indicated. If it remains stationary beyond forty-eight hours, one should seriously consider that the sharp point has engaged in the intestinal wall. Laparotomy should then be carried out and an attempt made to release the foreign body. There seems to be no need for special diet during the period of observation, although mineral oil in small amounts several times a day may seem indicated to prevent obstipation in the distal half of the colon. Surgery should not be instituted on the history alone but only on appearance of threatening signs and symptoms of perforation, or when there is more than a twenty-four to forty-eight hour delay in the passage of the object at any point along the gastrointestinal tract.

Correction: In an article by Dr. Harris and Dr. Feigen published in our August, 1946 issue, the authors wish to draw attention to an error they made on page 278. The sentence directly under the illustration in the second column should have read: "There is *some* question, however, as to whether every lymphocytoma which appears to be invasive and to show mitotic figures is clinically equally malignant."

WHY HERNIAS RECUR

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THE surgeon's primary concern while operating for a hernia, in spite of any technical refinements, is whether there will be a recurrence. It is a dogmatic soul indeed who, after operating for a hernia, can reply in the negative. The surgeon who can devise technics which are proof against any or all varieties of recurrence is well nigh worthy of the Nobel Prize. There are causative factors which are largely beyond his control and sometimes beyond his virtuosity as a surgeon.

In the latest literature the statistical average of primary recurrences varies from 0 to 20 per cent. With the secondary variety the average is even higher. Indirect inguinal hernias which occur in early life are not as commonly recurrent as the direct variety or saddle bag (pantaloon) hernias which are frequent in the older age group in which we find poor muscular and aponeurotic tissues.

An epigramatist once remarked that nothing is so constant as change. This is especially true of the pendulum of opinion regarding recurrences in hernial surgery—the incidence, causes, prophylactic and reparative measures. It is well known, for example, that there is wide divergence of view even among prominent surgeons regarding the architectonics and myodynamics of the lower abdominal, inguinal and femoral areas.

One of the problems which plagued ancient anatomists and surgeons was Nature's apparently faulty "architecture" at and including the abdominal or deep inguinal ring. In our own day many anatomists and surgeons are equally puzzled regarding the myodynamics of the deep inguinal ring and seek an answer to the questions: "Is the mechanism of the ring a shutter or a valve?" There are renowned proponents of each view. Manifestly, the correct answer to the question has a bearing on the success or failure of a technic utilized in a specific operation for indirect inguinal hernia.

THE OLD VIEW

The abdominal muscles prevent undue bulging of the abdomen, but they do not hinder the escape of the abdominal contents in the form of a hernial protrusion. The transversalis fascia, as a rule, is strong enough to retain the viscera within the abdomen. In other words, the fascias and aponeuroses and *not* the musculature prevent hernia formation.

The hiatus in the transversalis fascia lateral to the inferior epigastric vessels is covered by the internal oblique and transversus abdominalis muscle. Nevertheless, this site is the point of exit of the commonest variety of inguinal hernia,—the indirect or oblique inguinal.

On the assumption that this theory is correct, one may reason that to cure the hernia it is only necessary to close the hole in the transversalis fascia. However, in the majority of hernias this is impossible because of the contiguity of the inferior epigastric vessels. Radical cure of this common form of inguinal hernia is, therefore, anatomically impossible because of the futility of attempting to close the defect in the transversalis fascia. The surgeon endeavors to overcome this impasse by improvising an obturator of fascial, aponeurotic and muscular structures. The interposition of an unyielding fibrotic membrane is an inadequate substitute for a live contracting myodynamic shutter. It is advantageous instead to utilize the aponeurotic extensions of the conjoined tendon

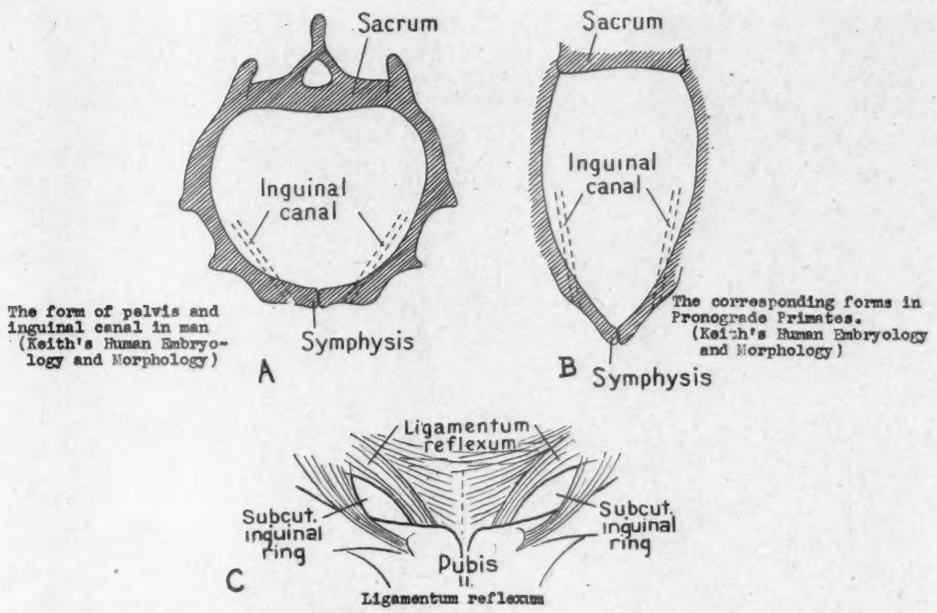


FIG. 1. Man's susceptibility to hernia, caused by the orthograde posture, is overcome by the visceral support and the obliquity of the inguinal canals.

and in large, direct hernias, where the deficiency is extensive, a fascia lata transplant.

The two important theories concerning the deep inguinal ring may be briefly reviewed here, as follows:

In 1923, Sir Arthur Keith, in his description of the mechanics of the "inguinal shutter," described the conjoined muscle as a "shutter" rather than a sphincter, with a mechanism similar to that which closes the eyelids. The inguinal ligament, the counterpart of the lower lid, remains stationary. Any weakness of this neuromuscular function, reflex in character, predisposes to hernia. In man's evolution the groin is weakened by the adaptations the pelvis had to undergo. In 1929, W. W. MacGregor stated his agreement with this view. (Fig. 1.)

THE MODERN VIEW

Keith, as we have seen, viewed the deep inguinal ring as a fixed opening. The modern view, however, maintained especially by W. J. Lytle of Sheffield (England), is that the ring is mobile—an active mechanism of closure which under stress moves *upward* and *outward* under cover of the internal oblique and transverse muscle.

The deep inguinal ring, when viewed on the posterior wall of the inguinal canal, is consequently a pivot around which the transversalis fascia is arranged. The U-shaped ring, composed of fibrous strands (incomplete superiorly) is placed obliquely and sometimes almost vertically midway between the anterior superior spine and the symphysis pubis. It has a thick and therefore strong inner margin and an angle below lies subjacent to the edge of the transversus muscle to allow free passage of the spermatic cord. The fibrous strands surrounding the ring vary in length and their ends are firmly anchored as "slings" to the posterior aspect of the transversus muscle. The prominent margins of the ring extend backward at an angle below the spermatic cord. Ring mobility, Lytle maintains, is easily demonstrated under a local anesthetic. If the edges are held under tension and the patient is requested to cough, the ring can be observed and felt to move *upward* and *laterally behind the internal oblique and transversus muscles.* On release of tension, movement of the ring on coughing is slight or absent. (Figs. 2 and 3.)

It is, therefore, obvious, Lytle argues, that the stretch reflex (closure mechanism) is activated in protecting the inguinal

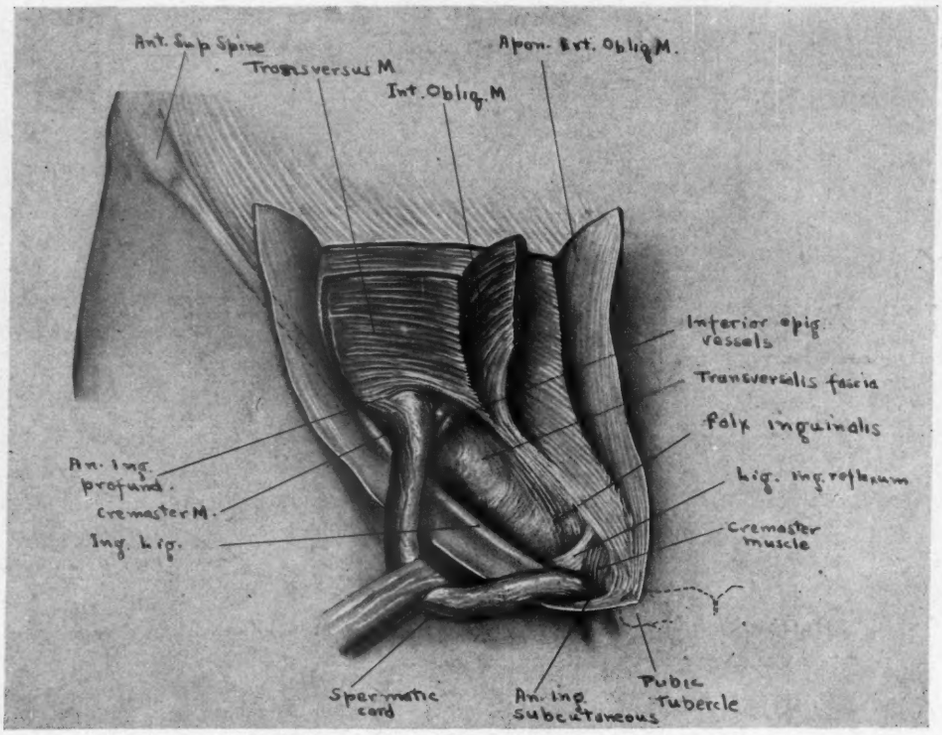


FIG. 2. The inguinal canal in male.

canal. The action consequently is that of *a sliding valve* and not of a sphincter or a shutter because it is arranged to avoid extreme pressure on the spermatic cord which both these mechanisms would tend to exert. It is also held that the amplitude of the medial pillar of the ring is greater than that of the outer. The first is fixed to the medial part of the transversus muscle and to its aponeurosis where the greatest range of muscular movement occurs while the outer pillar is anchored to the muscle fibers near their origin, where the muscle moves only slightly on contraction. The margins of the ring project and as the cord enters laterally and below the medial margin overlaps the opening and thus acts as a lid or valve protecting it against continuous but changing intra-abdominal pressure.

Varieties of Recurrence. The varieties of recurrence are: (1) Direct hernia, which is the most frequent (Fig. 4); (2) indirect hernia (Fig. 5); (3) saddle-bag or pantaloon hernia (Fig. 6); (4) Spigelian hernia, along semilunar line (Fig. 7); and (5) bladder hernia. (Fig. 8.)

ETIOLOGY OF HERNIA RECURRENCES

The causes, anatomic, congenital and technical, that conduce to recurrences in hernia surgery may now be considered.

Briefly stated, the main causes of recurrences are inefficient surgical technics and incorrect after-treatments. The basis of all surgical measures should be high ligation of the sac in indirect inguinal hernia, and careful repair of the attenuated transversalis fascia in the direct variety. Not infrequently indirect and direct inguinal hernia are concurrent and one is repaired and the other overlooked. Such an omission is due to an incomplete knowledge of the anatomy and myodynamics of the lower abdominal wall. The result is a persistence of the original anatomic defect or defects, congenital or acquired.

SURGICAL CAUSES

Pre-surgical. The pre-surgical causes are: (1) Incorrect diagnosis; (2) poor planning. This involves improper choice of operation as shown, for example, in the use of the Bassini operation or one of its

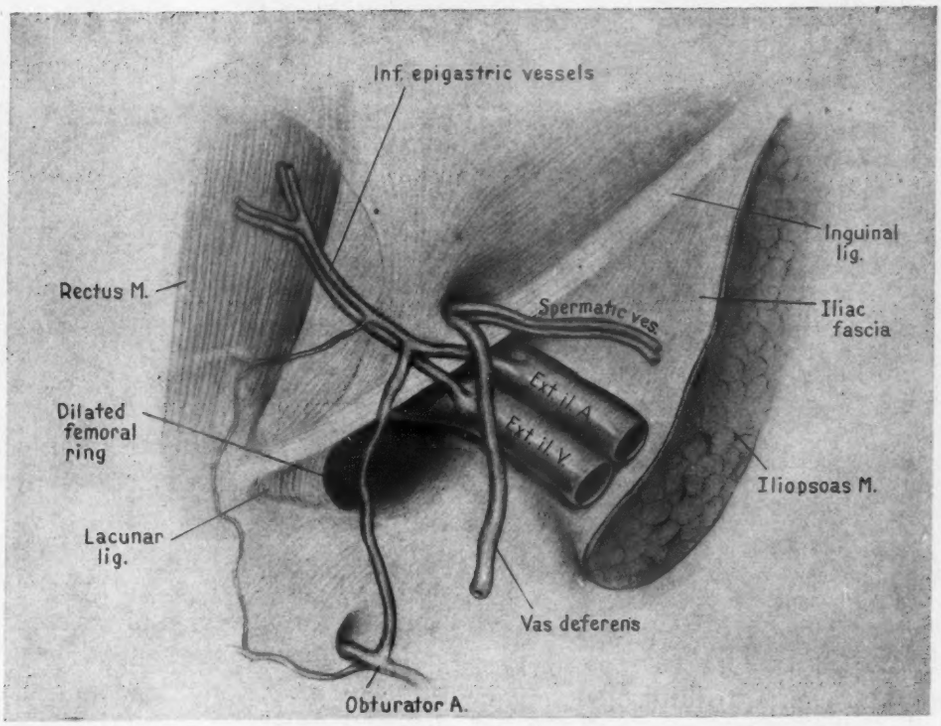


FIG. 3. Vessels, muscles and ligaments of the inguinal region seen from within.

modifications, in infants, older children and young adults. (3) Unsuitable selection of patient. The patient should be carefully examined to determine the presence or absence of such conditions as excessive obesity, asthma, acute or chronic bronchitis, myocarditis, active syphilis, hemophilia and other blood diseases. There must be proper pre-surgical preparation, such as care of the heart, diminution of abdominal distention and measures leading to reduction in weight.

Surgical. (1) Anesthesia. The kind of anesthesia used is of importance in the prevention of recurrence. The patient must be completely relaxed during a hernial operation. This permits tensionless apposition of tissues. Spinal anesthesia is therefore the method of choice. (Huston reported only 0.8 per cent recurrences where this variety of anesthesia was used.) There are few post-surgical complications,—vomiting, distention, and undue body strain, for example, in the use of spinal anesthesia. (2) Wrong choice of operation, (3) improperly placed incision, (4) incomplete asepsis, (5) poor hemostasis, and (6) other technical errors. Prior to the ligation of the sac the surgeon should explore the nether surface of the inguinal floor. Hidden defects will thus be discovered as well as the laxity or strength of available tissues in the contemplated reconstruction of the wall. At the primary operation, weakness, dehiscence or absence of fascia transversalis may not have been noted as well as the presence of a large femoral ring or underdeveloped inguinal ligament. A correct interpretation and evaluation of the structural defects present is therefore of transcendent importance, as well as a proper repair at the time of reconstruction. The utilization of fascia strips, or pedicle graft, where the fascia transversalis is *not* structurally weak or underdeveloped, is an incorrect surgical procedure. Its routine use in various recurrent hernias is unjustified.

(7) Failure to detect or correct "sliding" hernia,—to discover the direct component of the protrusion. This is especially true after the age of forty. Surgeons sometimes fail to carry the peritoneal dissection high enough to separate the direct sac from the bladder wall and undersurface of the

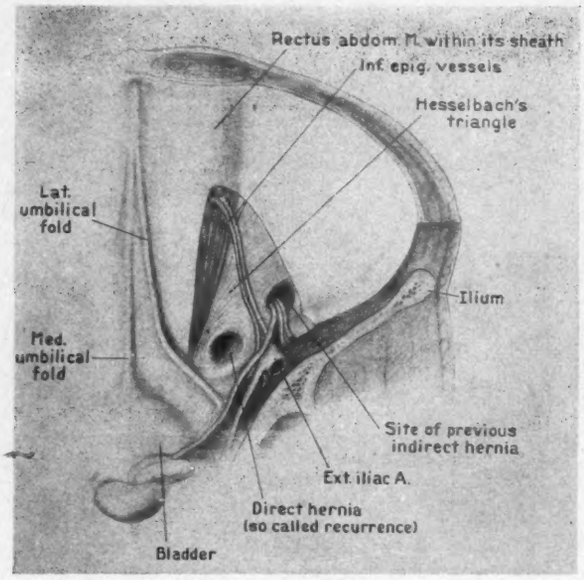


Fig. 7. Spigelian hernia.

inguinal floor. (8) Failure to narrow the deep abdominal ring; (9) failure to repair defects in the inguinal triangle; (10) failure to transplant spermatic cord in older age group; (11) failure to remove spermatic cord in elderly patients. Removal of the spermatic cord, in conjunction with hernioplasty, is definitely indicated in the large hernias of persons over sixty years of age; (12) division of nerves. This leads to the destruction and atrophy of the affected parts of the lower abdominal wall; (13) failure to use fascial transplant where muscles and aponeuroses are deficient.

(14) Improper suture material. Most authorities condemn the use of catgut in herniorrhaphy. Longacre, for instance, wrote that with indirect hernia the "catgut" recurrence rate is 12.5 per cent and with silk 3.4 per cent and in direct hernia 13.6 per cent as compated with 4.49 per cent. The use of absorbable or non-absorbable material, in my experience, does not influence the final results in hernioplasty. There is, however, an increasing tendency to use non-absorbable suture material. Fascial sutures of the transplanted variety, e.g., autogenous material, yield somewhat better results in difficult hernias than plain catgut or silk. The utilization of the pedicle flap (such as fascia lata transplant with

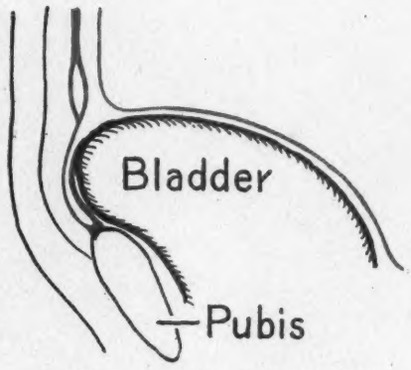


Fig. 8. Bladder hernia.

conservation of its nerve and blood supply) has a distinct advantage over fascial sutures.

(15) Unwise use of drainage tube and its improper placement and prolonged retention. In the presence of sepsis the proteolytic action of the pus digests adjacent tissues, converting it into granulation tissue and as a result the wound is liable to stretch or burst during an increase of intra-abdominal pressure from any cause. (16) Bilateral operations in people over forty-five years of age in whom there is a large hernia or weakness of muscular and aponeurotic structures.

POST-SURGICAL CAUSES OF RECURRENCES

Weight bearing should be postponed until the scar tissue, on which the union of the deep layers depends, has consolidated. This requires a minimum of seven days in bed.

Immediately after the operation the patient should be warned to avoid coughing as far as possible, not to strain at bowel movements and not to attempt to raise himself in bed.

Omission of the warning regarding strain or hard work for three months after the operation is another cause. This applies to active physical occupations, especially in persons over forty-five years of age.

Patients past forty-five years of age with large hernias and poor muscles and aponeuroses and with extreme weakness in the inguinal triangle should not be permitted to return to laborious work. The percent-

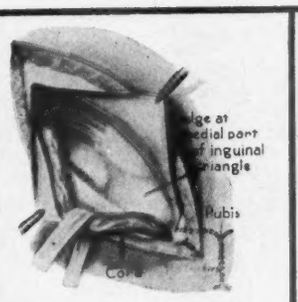


Fig. 4

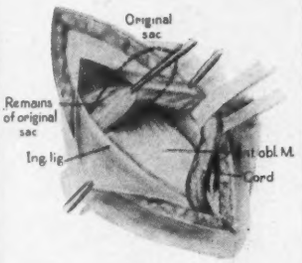


Fig. 5

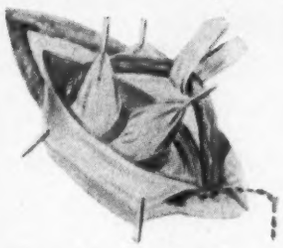
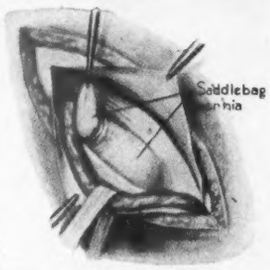


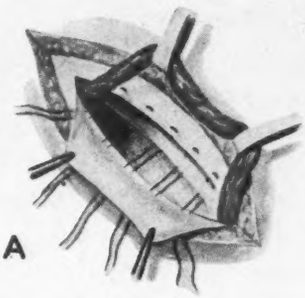
Fig. 6a



6b

WYLLYS ANDREWS METHOD (MODIFIED)

CORD PLACED SUPERFICIAL TO EXTERNAL OBLIQUE.



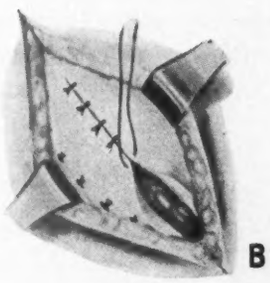
INADEQUACIES

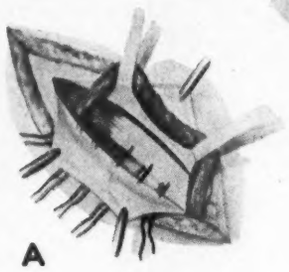
1. Cannot be used in majority of hernias
2. Cannot be employed where tendo conjunctus is weak.
3. Fascial reinforcement is superficial to defect

Fig. IIa

BASSINI METHOD

CORD PLACED SUBJACENT TO EXTERNAL OBLIQUE.





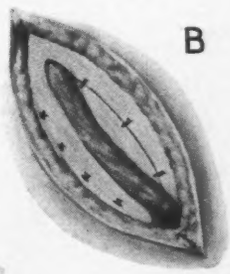
INADEQUACIES

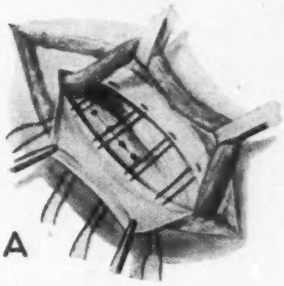
1. Strangulate internal oblique resulting in atrophic scar tissue
2. Muscle bundles offer no protection against pressure perpendicular to fibers
3. Places tendo conjunctus in abnormal position

Fig. 10

AN ANATOMICAL PHYSIOLOGICAL HERNIAPLASTY

CORD PLACED SUPERFICIAL TO EXTERNAL OBLIQUE.





1. Approximates similar structures
2. Re-enforces weak transversalis fascia

Fig. IIb

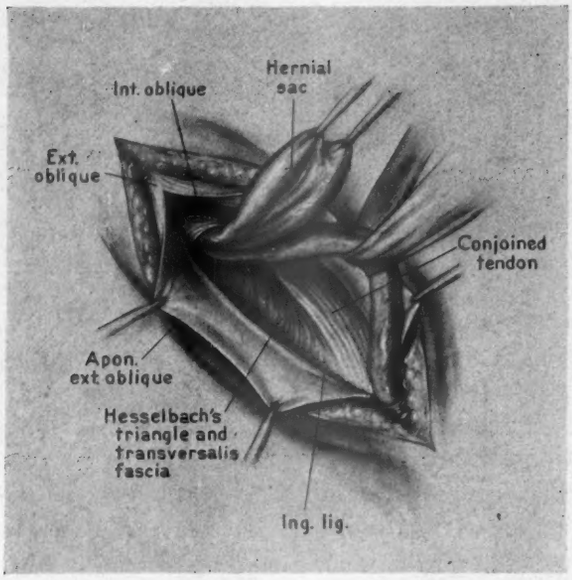


Fig. 9. Indirect inguinal hernia. Good musculo-aponeurotic structures; simple high sac ligation will effect a cure.

age of recurrences in this group is too large. They should be assigned to lighter occupations.

Evaluation of Surgical Technics

Another perennial polemic subject relating to hernia recurrences concerns the adequacy or inadequacies of the various so-called standard operations for indirect inguinal hernia. In the younger age group, where there are, as a rule, good muscular, aponeurotic and fascial structures, a simple high sac ligation with excision of the redundant portion is all that is necessary for a complete cure. (Fig. 9.)

It is widely urged by surgeons that in the Bassini operation and its various modifications (Halsted, Ferguson, and others), certain steps are not only unnecessary, but actually a basic factor in the recurrence of the hernias, especially in those of short duration, in which the deep ring is only slightly stretched. The musculature is unnecessarily injured, thus favoring a recurrence. It will be recalled that all the modifications of the Bassini operation utilize the suturing of the internal oblique and conjoined tendon to the dense inguinal ligament. (Fig. 10.)

Suture of the conjoined tendon to the inguinal ligament, one of the steps in a Bassini repair, is fallacious because there is often no weakness in the floor of the canal and muscle is not a perfect bastion, its function being largely that of motion. Furthermore, muscle anchorage results in atrophy from disuse and is weaker than before because of traumatic myofibrosis. Recurrences are thus induced by disordered myodynamics. It is known that; in the main, they do not occur through the posterior wall of the inguinal canal but through the abdominal inguinal ring. There is recurrence in the true meaning of the word. (The ring, unlike a parachute, functions best when closed).

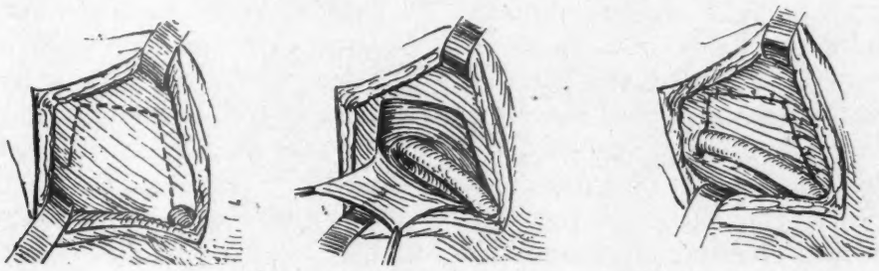


Fig. 12. A, B and C, steps in the Beach operation.[6]

It is manifest, therefore, that the control of the inguinal area depends on the unimpeded action of its musculature and an operation which interferes with its normal mobility diminishes the strength of the lower abdominal wall and tends to induce, rather than prevent, recurrence. This is clearly shown by the cures in infants and children after mere ligation and excision of the hernial sac. The percentage of cures is better than the best results obtainable in adults. No buttressing is needed since the

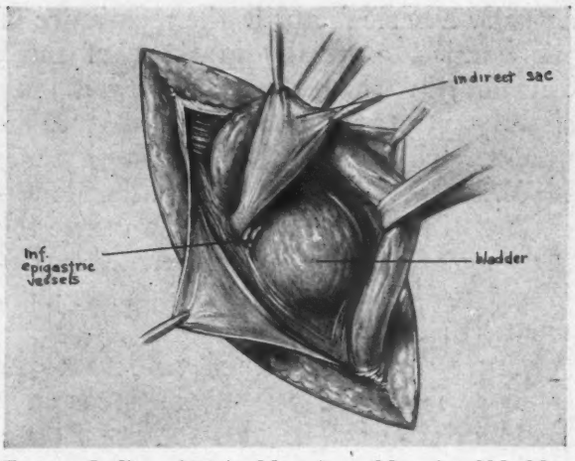


Fig. 13. Indirect inguinal hernia and hernia of bladder in inguinal triangle.

local myodynamics remain undisturbed and the muscular and aponeurotic structures have not been overstretched.

Anson and McVay found that the basic errors in the Bassini technics are due to a not uncommon misunderstanding of the surgical anatomy of the inguinal area. They maintained that the inguinal ligament is not the site of the insertion of the internal oblique and transversus muscles and is not anchored securely enough to withstand the pull of the abdominal muscles.

In patients operated on for recurrent inguinal hernia the ligament is displaced upward completely exposing the lower inguinal region. In some instances there is no vestige of the original ligament. Anson and McVay advocated utilization of the conveniently located superior pubic ligament, a dense fibrous structure on the anterosuperior aspect of the pubic ramus.

In view of the aforesaid it is suggested that owing to the proved fatuity of the Bassini operation and some of its modifications it should be considered antiquated. For indirect inguinal hernia, in well developed persons, in whom the deep ring is not greatly enlarged, simple hernioplasty or herniorrhaphy with repair of the transversalis fascia deep to the muscles at the ring is deemed adequate. For large hernias, direct or indirect, primary or secondary, a modification of the Wyllys Andrew operation is most effective.

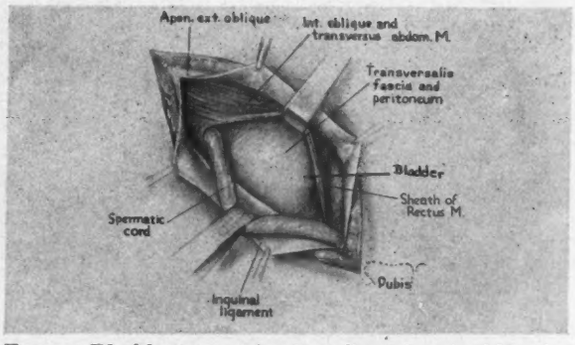


Fig. 14. Bladder protrusion in a direct inguinal hernia.

The method used by the author is clearly demonstrated in Figure 11. It will be seen that the cord is placed superficially, subjacent to the deep layer (Scarpa's) of the superficial fascia. The repair does not compromise the activity of the abdominal muscles.

Some reparative or restorative technic is necessary, one which, as already emphasized, interferes least with the musculature. The inferior margin of the transversus abdominis aponeurosis and attached transversalis fascia are sutured to the inguinal ligament from the pubic tubercle to the femoral vein by a series of interrupted silk or catgut sutures.

When an oblique inguinal hernia increases in size the deep ring and especially its lateral margin gradually stretches, weakening and lessening its mobility. Mere removal of the sac is inadequate because a dilated ring leaves a weak spot, and unless the ring is narrowed to normal size the sliding valve mechanism does not function adequately. A dilated ring may be the result of, and probably also a causal factor in, indirect inguinal hernia.

In order to circumvent the basic error in the Bassini and other operations in the repair of indirect inguinal hernia, W. W. Beach urges that his technic will avoid recurrences, one in which "all repair of the posterior wall of the inguinal canal is completely avoided and the canal itself suppressed."

In this operation a flap from the aponeurosis of the external oblique is utilized to replace the inguinal canal by an "in-

Fig. 15. Large direct right inguinal hernia. No evidence of an indirect hernia. The bladder constituted the entire hernia.

Fig. 16. Saddle-bag hernia, showing two sacs; the smaller one is the bladder.

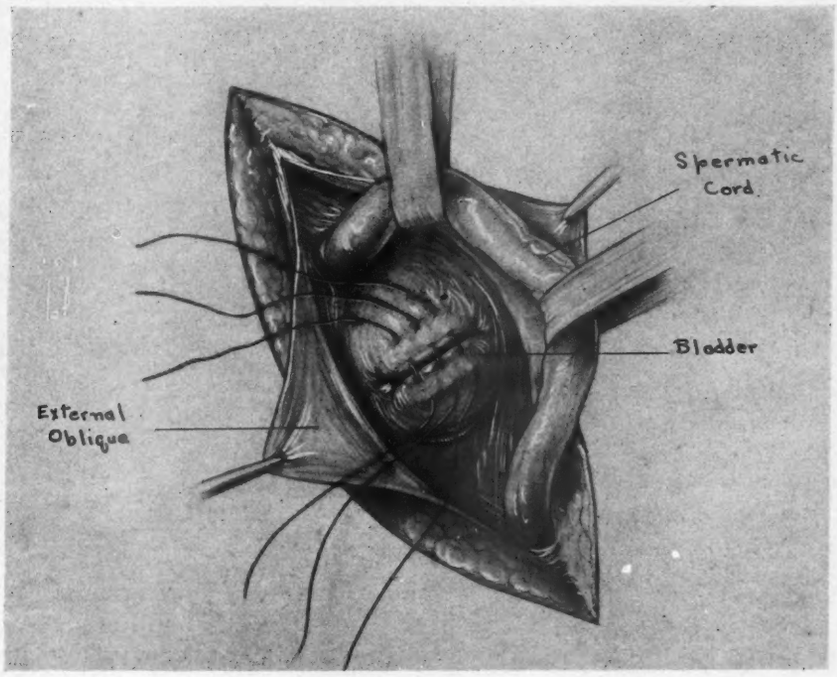


Fig. 17. Reducing redundancy in bladder wall. Former method of repairing bladder hernia.

guinal exit lateral to and above the center of the abdominal inguinal ring." He maintains that not only is the subcutaneous ring obliterated, but a gravitation obstacle is put in the way of a recurrence. (Fig. 12, A, B, and C.)

Fundamentally, the Beach procedure in uniting like tissue in a more complicated manner does not accomplish any more than a modified Wyllys Andrew operation.

Another operation designed to obviate recurrences is that advocated by Mair, in which whole skin implants are inlaid, under extreme tension to protect the posterior wall of the inguinal canal and to narrow the deep inguinal ring. He believes this technic is superior to those utilizing fascial grafts.

The transplantation of a cutis graft inlay is highly valued by the proponent of the technic. However, dissimilar tissues are united and an inert protective membrane is utilized as a graft in which tissue of tensile

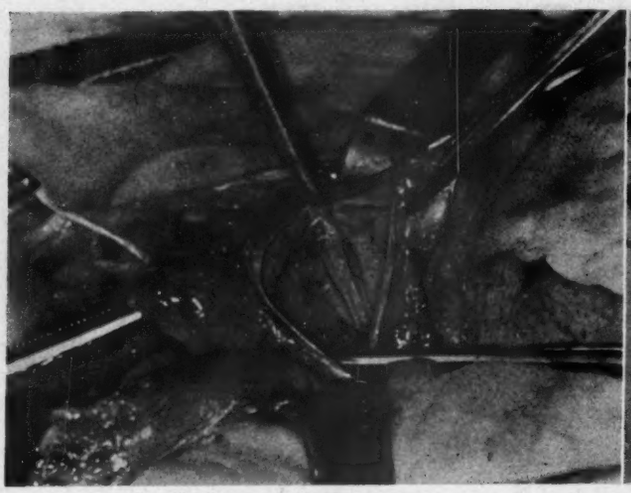


Fig. 18. Bladder protrusion has been resected, ready for closure; new method.

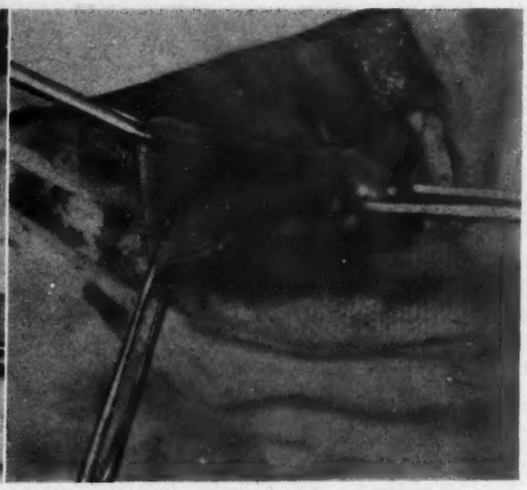


Fig. 19. Another case after resection of bladder protrusion; new method.

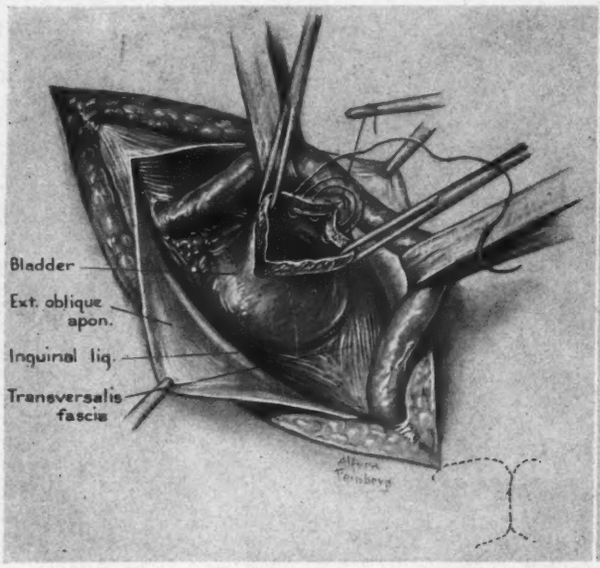


Fig. 20. Closing bladder with Connell suture after excision of herniated part.

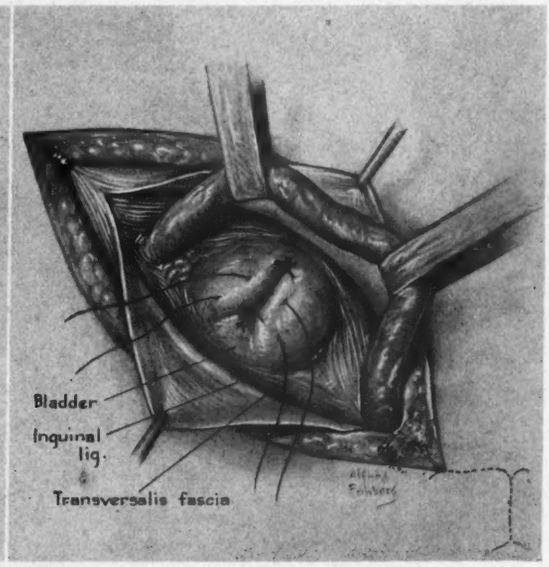


Fig. 21. Re-enforcement with interrupted Lembert sutures.

strength is required. The value of the technic, it seems to me, is still open to proof.

One of the most difficult varieties of hernia to repair is that in which the minor or major part of the content is the protruded bladder wall. It is either a complication or an integral part of an inguinal hernia. Statistical studies reveal an incidence of 1 to 3 per cent, but in my experience it is at least 15 per cent in persons over fifty years of age with inguinal hernias of moderate size.

In so-called recurrences after operations for inguinal hernia one must, therefore, anticipate a return of an imperfectly repaired bladder protrusion. Failure on the part of the surgeon to analyze the anatomic basis of the swelling and having recognized it, timidity in opening the bladder and dealing adequately with it, are the fundamental causes of recurrences.

There are three varieties of primary inguinal bladder hernia (Figs. 13, 14, 15 and 16): (1) As part of a direct inguinal hernia through the inguinal triangle, without evidence of an indirect inguinal sac. The base is sessile and covered by an attenuated transversalis fascia. (2) As a complication of an indirect inguinal hernia in which there

is no direct connection between the bladder protrusion and the indirect inguinal components. (3) As the medial part of a saddle-bag or pantaloon hernia in which the lateral bladder wall protrusion is part of the medial wall of an indirect hernial sac. Here again, the transversalis fascia is attenuated to an extreme degree. Occasionally the intraperitoneal portion of the bladder lies directly within the hernial sac.

During the surgical repair of this form of hernia it is well to be circumspect regarding: (1) An undue collection of adipose tissue contiguous and medial to the sac; (2) isolation of the sac; (3) dimensions of hernia; and (4) location (urinary bladder hernias ordinarily are found closer to the medial line than other varieties).

In the past it has been customary with most surgeons to repair the hernia in the accepted manner and to cover the bladder protrusion by reinforcing it with the overlying muscular and aponeurotic structures (Wyllys Andrew, Halsted or Bloodgood, technics). (Fig. 17.)

I usually eliminated the bladder redundancy by either a double purse-string inversion or by a double layer of interrupted Lembert sutures, and then followed the ordinary technic for a direct or indirect inguinal hernia. (Figs. 18 to 22.) However, there have been too many recurrences of bladder protrusion in all of the three varieties previously mentioned. I have, therefore, devised the following procedure which appears to be of high efficacy:

The repair of the bladder hernia is the same in the three varieties. In the second one, the small, indirect hernial sac must be removed first, prior to the repair of the bladder protrusion. In this sequence there is no danger of contamination because the bladder has not only been completely emptied by catherization at least twenty-four hours before the surgical intervention, but irrigated several times with a weak antiseptic solution. The catheter is not removed until seventy-two hours after the operation. In the third variety, traction is made on the indirect component of the sac

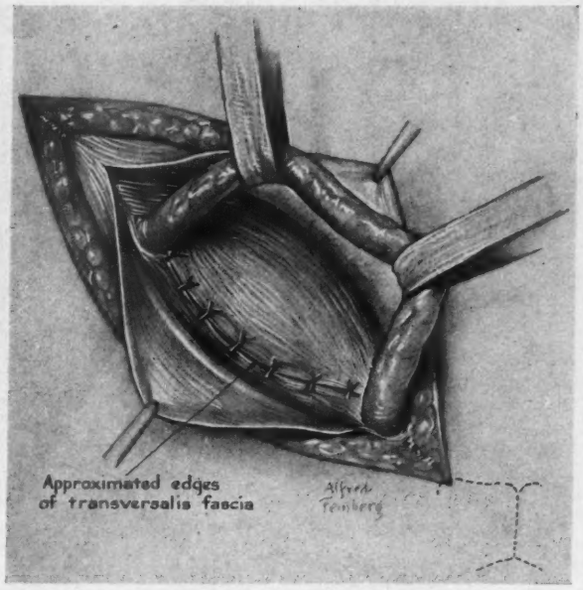


FIG. 22. Approximation of edges of transversalis fascia with interrupted sutures.

(as in the repair of all saddle-bag hernias). The bladder protrusion is partly displaced medially; the indirect hernial sac is opened so as to visualize the extent of encroachment on its wall and to avoid puncturing the bladder in the transfixion of the indirect hernial sac. The following technic is then used for the repair of the vesical hernia:

The base of the diverticular protrusion is caught by several Allis clamps and the redundant part exsected. After thorough hemostasis, the edges of the stoma are inverted by means of a Connell stitch, which is reinforced with interrupted Lembert sutures, utilizing No. 0 chromic catgut on an atraumatic needle. The margins of the transversalis fascia are then approximated and sutured with interrupted strands of No. 0 chromic catgut. The hernial repair is then continued with the utilization of one of the technics commonly found acceptable in the repair of direct inguinal hernia.

Digital exploration of the bladder cavity may be carried out and closure is then accomplished after a change of gloves.

There have been no recurrences in my series of thirty-seven patients. There was one wound infection and no urinary extravasation in the surgical area.

Seelig and Chouke, after an investigation of the moot question of union of muscle

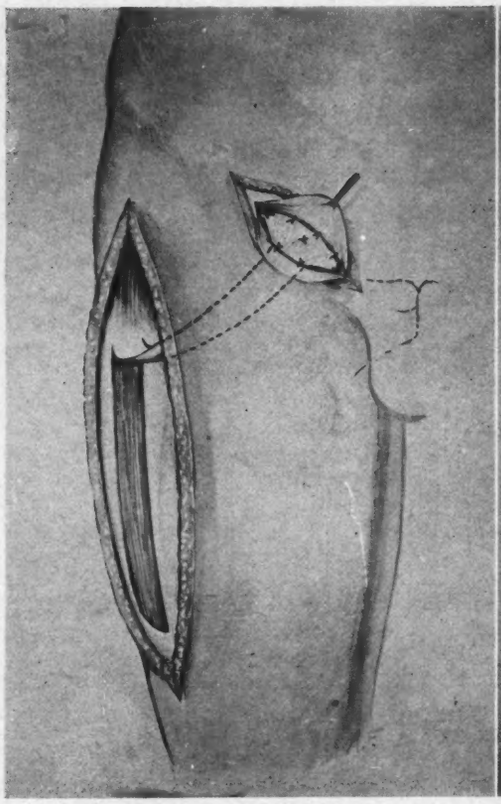


FIG. 23. Placement of fascia lata graft.

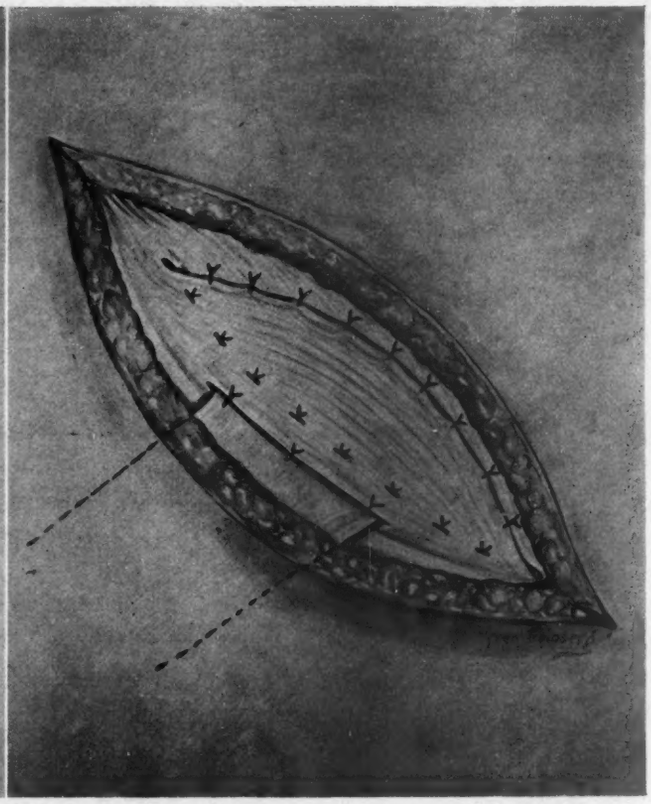


FIG. 24. Appearance of fascia lata graft in recipient area.

and fascia concluded that "normal muscle will not unite firmly with fascia and ligament. It is, therefore, a useless procedure to suture the abdominal muscles to the inguinal ligament in the hope of buttressing a weak or ruptured abdominal wall." When two living fascial planes are approximated there is complete and enduring union.

With extreme relaxation of the inguinal triangle consequent on the absence or inadequacy of the transversalis fascia, whether it be due to weakness, with loss of physiologic and anatomic functions of the abdominal wall as a bulwark, the utilization of pedicle flap fascia lata transplants has unparalleled values. It is a truism that all ameliorative efforts, medical or surgical, should be strictly individualized. The procedure has been adequately described as indicated in the references. (Figs. 23 and 24.)

The transplantation operation is justified on the following theoretic and practical grounds: (1) It is an attempt to produce better results by serving as a reenforcement for the inguinal triangle. (2) The inguinal ligament and tendo conjunctus are not drawn together, thereby distorting their relationships. Their function capacity is preserved, truly a conservation of natural resources of the part. (3) The iliotibial band is the only accessible and mobilizable fascial musculature available. With an intact nerve and vascular supply, its elasticity, contractility and extensibility are retained. The myodynamics of the area remain undisturbed.

It is manifest, therefore, that the use of living fascia in the repair of certain varieties of large and complicated hernias is of transcendent value as compared to all other forms of suture material. The probability of recurrence is then diminished.

PREVENTION OF RECURRENCES

In order to prevent recurrences it is necessary to adhere to certain basic surgical principles; (1) Elimination of causes as far as possible; (2) reestablishment of natural physiologic and mechanical forces; (3) avoidance of technical errors, especially of

STUDY OF 3,000 CASES

Varieties	Sac	Transversalis Fascia	Secondary Protrusion	Repair	Closure
1st Degree.....	Indirect	Normal	None	Sac ligation	Normal
2nd Degree....	Indirect	Weak	None	Sac ligation, plication of fascia	Modified Wyllys Andrew
3rd Degree....	Saddle-bag or pantaloon	Weak	Yes	Conversion into indirect sac or ligation of both sacs separately. Plication of fascia	Modified Wyllys Andrew, with or without fascia lata transplant
4th Degree....	Saddle-bag or pantaloon	Weak	Bladder diverticulation	Ligation of indirect sac. Bladder diverticulectomy. Plication of fascia	Modified Wyllys Andrew. Bladder diverticulectomy with or without fascia lata transplant

Note: In those beyond sixty years of age, either removal of cord or vasectomy in addition.

suture tension; and (4) selection of the proper surgical procedure.

CONCLUSIONS

1. Until comparatively recent years primitive concepts held sway concerning the etiology and physiological anatomy of hernia. Based on these concepts, surgical procedures were carried out which in our day seem to transcend the limits of human credulity, but which received the sanction of surgical custom.

2. With a profounder knowledge of the anatomy and physiology of hernia, investigators have attempted not only to classify the varieties of hernia, but also to devise a special procedure for each.

3. Recurrences, nevertheless, occur though less frequently.

4. A classification of recurrences is herewith presented in an attempt to clarify not only the causes of failure but also to form a basis for the choice of special operations.

5. A further study of the recurrences which is now being made reveals a progressive diminution in the incidence of failures.

REFERENCES

1. Moschowitz, A. V. Johnson's Operative Therapeusis. New York, 1915. D. Appleton & Co.,
2. MacGregor, W. W. *Surg. Gynec. & Obst.*, vol. 49, p. 273.
3. Turner, Philip. *Guys Hosp. Rep.*, vol. 9, Series IV, p. 234.
4. McVay, Chester B. *Micb. Univ. Hosp. Bull.*, 5: 14, 1939.
5. Anson & McVay, *Surg. Gynec. & Obst.*, 55: 286, 1932.
6. Beach, M. V. Inguinal hernia. *Brit. J. Surg.*, 32: 499–502, 1945.
7. Skinner, H. L., and Duncan, R. D. Recurrent inguinal hernias. *Ann. Surg.*, 122: 68–83, 1945.
8. Mair, Leo B. *Brit. J. Surg.*, 32: 381, 1945.
9. Seelig, M. G. and Chouke, K. S. *Arcb. Surg.*, 7: 553–572, 1923.
10. Wangensteen, O. H. *Surg. Gynec. & Obst.*, 59: 766–780, 1934.
11. Iason, A. H. Herniation of bladder. *Am. J. Surg.*, 63: 69, 1944.
12. Jaboulay and Villard, Des hernies inguinales et crurales de la vessie. *Lyon med.*, 1: 106, 1895.
13. Eggenberger, H. Harnblasenbruche. *Deutscbe Zeitscbr. f. Cbir.*, 94: 524–579, 1908.
14. Iason, A. H. Indirect inguinal hernia. *Am. J. Surg.*, 7: 757, 1929.
15. Iason, A. H. Hernia. Philadelphia, 1941. Blakiston Co.
16. Iason, A. H. Fascia lata transplant for difficult hernias. *Surgery*, 13: 511, 1943.
17. Longacre, Alfred B. *Surg., Gynec. & Obst.*, 68: 238, 1939.

VASCULAR TRAUMA

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BECAUSE of the dramatic impact of massive hemorrhage, man's attention in all wars has been directed to the diagnosis and treatment of vascular trauma. In no preceding war, however, have the opportunities for study, observation, diagnosis and treatment been more feasible and extensive than in this past great battle of World War II.

This has been due to two basic facts: (1) greatly improved methods of combating shock, hemorrhage, and infection so that the wounded soldier lived to be treated definitively for his lesion in a hospital, and (2) the multiplicity of wounds in a single individual arising from the greatly improved missiles and death dealing implements that have been devised. We have observed numerous cases in which an individual soldier has had twenty to thirty varying sized perforating, penetrating and lacerating wounds, each of which is a potential source of vascular trauma. Elkins has noted as high as a hundred separate wounds in some of the men observed by him at the Vascular Trauma Center.

It is the aim of this paper to describe and give the general rules of treatment for the various types of arterial lesions which were observed in a General Hospital functioning for eighteen months close behind the combat zone. I am cognizant that this paper is presenting no new evidences, or disease or revolutionary methods of therapy. That has not been the object. It is the desire only to present in one paper a summation of the known and approved principles of diagnosis and treatment of vascular trauma.

It is believed that many patients passed through our hands in whom a diagnosis of vascular trauma was not made because, first, we received the patients shortly (two to five days) after the injury, and second, we rapidly disposed of them by evacuation to the rear in seven to fourteen days after trauma. In this comparatively short period many lesions did not have sufficient time to manifest themselves either by clinical signs or symptoms, as frequently evidences of vascular injury are not encountered for several months following the initial trauma.

THE TOURNIQUET

The primary concern in the treatment of vascular injuries is the arrest of hemorrhage and the preservation of life. This control of major bleeding is often accomplished with the application of a tourniquet which, however, if one is to avoid further damage to the extremity, must be used intelligently and with understanding. The origin of the tourniquet has been lost in antiquity but the catastrophes that accrue from its improper use are still prevalent. To borrow and paraphrase a saying the tourniquet is used "too often, too tight and too long." It is agreed by all investigators that the ideal tourniquet is a pneumatic cuff allowing easy and ready control of pressure without disturbing the patient. However, on the field in war, or in an emergency in civilian life, where this type of apparatus is not handy, an Esmarch bandage or even rubber tubing placed over a cloth will suffice. The tourniquet should be applied as close to the wound as possible. A tourniquet applied below the elbow or knee is of no value as the interosseous arteries cannot be compressed by this means, and with occlusion of the vein and no slowing of arterial flow the end result will only be increased hemorrhage. Holman has suggested that any limb which has a tourniquet applied should be encased in chipped ice. By this procedure, the length of time the tourniquet applied can be left in place is increased to five to six hours, bacterial growth is inhibited, shock re-

duced and comfort increased. Allen has even suggested that by the time the patient arrives at the Evacuation Hospital the débridement of the wound could be done without further anesthesia, the ice having sufficiently chilled the tissues to allow operative procedures to be instituted.

The complications that follow misuse of the tourniquet are often disastrous and often more permanently disabling than would have been the loss of blood for which it was applied. Paralysis of the peripheral nerves is not uncommon, and though this is usually temporary and subsides in five to nine months, it may be permanent. Spiegel and Levin report three such cases in which operative intervention showed necrosis, neuromas, adhesions and intraneural scarring of the involved nerves. We observed a case of a British flier who had complete loss of motor and sensory nerve impulses 2 inches below the knee. No lesion could be found which would explain this complete nerve blockage, but on questioning we learned that a tourniquet had been applied tightly for a long period of time to arrest a slight amount of bleeding.

It is believed that most bleeding, even profuse hemorrhage from a major vessel, can be satisfactorily controlled by elevation of the extremity and the application of steady, firm pressure by the use of an elastic bandage, wrapped over several thicknesses of gauze, or still more satisfactorily by manual pressure. This latter method was well illustrated in a patient with a compound comminuted fracture of the femur (upper one-fourth) who two weeks after injury suddenly developed severe secondary hemorrhage. The patient was in a spica and a tourniquet could not be applied. Bleeding was controlled by the application of firm, constant, manual pressure over the bleeding site. If technically possible, the ideal method of controlling bleeding is, of course, the application of hemostatic clamps directly to the offending vessel.

The point to be stressed is that prolonged application of a tight constricting band to control bleeding is not necessary. Do not let this be a case in which the cure is worse than the disease.

ARTERIAL SPASM

This syndrome first described by Leriche is not dependent on actual trauma to the vessel itself for its production. A missile passing close to the artery and traumatizing the surrounding tissue would be sufficient cause to institute spasm of the wall. This condition is produced by reflex vasoconstrictor impulses of the sympathetic nerves, and may in extent be local, segmental, involve the entire length of the vessel or even cause spasm of all the collateral branches of the limb. It is most frequently transitory, but may persist for a sufficient length of time to cause the extremity to become cold, pulseless and paralyzed, and in the extreme case may even terminate in fibrosis, atrophy, thrombosis of the vessels and ischemic gangrene of the limb, necessitating amputation.

Whether actual blood vessel trauma has or has not been sustained can be determined only by careful observation at the site of the injury for evidence of vascular damage, by visualization of the path of the missile (whether or not it embraces a major vessel), and occasionally by the use of the oscillometer which would give information as to whether the collateral vessels have been shut down. Pathological examination, both gross and microscopic, of a vessel in spasm will show no abnormalities of structure.

Treatment of vasospasm resolves itself, in order of application, into: (1) débridement of all traumatized tissue and removal of the foreign body, (2) repeated paravertebral sympathetic blocks using novocain preparation, (3) periarterial sympathectomy and finally, (4) sympathectomy. All of these procedures are aimed at the removal of the sympathetic impulses which have occluded the lumen of the vessel. The use of the external heat above 88 to 96°F. to increase the vascular flow is

definitely contraindicated as this merely increases tissue metabolism and thereby increases the speed with which tissue necrosis and gangrene will appear.

LOCALIZED CONTUSION

It is not necessary that severence, partial or complete, result from trauma to the vessel wall. If the velocity of the missile be spent so that the wall is not penetrated but merely struck, or takes such a course that it merely bruises the wall and does not sever it, a contusion of the vessel wall is said to result. Often the missile is large and flat, and in its course merely slaps against the wall of the vessel without penetrating it.

In these cases of contusion damage to the intimal layer of the vessel is much more marked than is damage to the adventitia, and microscopic examination of the vessel will show marked fraying and tearing of the former layer. There is no definite treatment to be instituted on the vessel itself, but the usual careful débridement at the site of injury must be undertaken. However, if vasospasm results the outline given above should be followed to combat this complication.

The chief concern here is not in the lesion itself but with the complications that may result. Spasm has already been discussed and the others can be determined only by close observation of the patient, his general condition, as well as the progress of the local lesion. The resultant complications are: (1) local obliteration of the vessel, (2) blow-out or secondary hemorrhage, (3) traumatic aneurysm, and (4) embolism.

LACERATING WOUNDS

These are the direct wounds to the vessel wall, and are caused not only by the sharp missiles which impart a clean tear to the wall, but also by jagged objects which cause gaping lacerations and which occasionally tear out segments of the wall. For convenience these lacerations may be classified as: (1) complete or incomplete, (2) transverse or longitudinal. It has been shown in experimental animals that an incomplete tangential laceration of a vessel wall will result in more profuse hemorrhage, (bleeding often continuing until the death of the animal) than does a complete severance of the vessel. In the latter case the elastic fibers cause a retraction of the severed ends into the surrounding fibrous tissue and a folding in of the intima and this, in association with the resultant vasospasm, often causes spontaneous cessation of the bleeding. The emergency treatment consists of the arrest of bleeding, either by pressure, tourniquet or by clamping and/or ligating the bleeding vessel. This is all that should be done at the site of the injury. Definite treatment is to be deferred until the patient reaches a hospital.

Treatment consists of débridement of the entire wound first, and then the paying of especial attention to the blood vessel itself. If the lesion is applicable to repair, suturing of the laceration may be undertaken using atraumatic needles carrying fine silk and including only the adventitia and media in the bite. The suture line should be re-enforced by a strip of muscle or fascia for added support. If there is a defect which cannot be bridged by the arterial wall itself, this may be overcome by flexion of the neighboring joint or a piece of vein wall may be sutured over the defect and used as a bridge gap. Recent work has been done with the use of cellophane and vitallium as a substitute for the wall. It is believed by most investigators that if excision of the vessel can be safely done without danger of gangrene of distal tissue (as radial or ulnar arteries, anterior or posterior tibial arteries) that this procedure is to be preferred to repair by suturing or end-to-end anastomosis. It has been observed in many cases that suturing is followed by thrombosis, arterial spasm and later by aneurysm of the wall of the repaired vessel. Regardless of the surgical procedure attempted full use should be made of all the adjuvants which the surgeon can obtain: blood, plasma, sulfonamides, penicillin, heparin, pre- and post-

operatively to prevent thrombosis. Also, postoperatively, optimum position and splintering for not too long a period should be instituted. At the end of two to three weeks immobilization should be discontinued and physiotherapy begun.

If it is decided that repair is not feasible and ligation of the artery must be done, this should never be "ligation in continuity" but ligation above and below the site of injury and removal of the complete segment of the artery. By this latter procedure the vessel walls are allowed to retract and become thicker, so that danger of slipping of the ligature and/or erosion of the vessel wall, due to the arterial pressure with secondary hemorrhage, is diminished, and additionally ligation and excision causes a complete interruption of the periarterial sympathetic nerves so that reflex vasospasm distal to the injury site will not occur.

TRAUMATIC ANEURYSM (PULSATING HEMATOMA)

When laceration of the arterial wall occurs, or when a contused wall "blows out," and the sinus to the exterior is a small or blocked, bleeding occurs into the perivascular tissue. The amount of hemorrhage that results is dependent on the site of extravasation. Where there is loose areolar tissue the hematoma will be extensive, and where firm fascial layers intervene it will be more confined and limited. Bleeding continues into the surrounding tissue until the pressure in the hematoma is equal to that of the arterial blood pressure at which time bleeding will cease. Clotting of the surface blood then occurs, which finally forms a firm organized fibrotic surface eventually becoming lined with a layer of endothelium, forming a sac resembling an aneurysmal dilatation in which a continuous flow of blood occurs. Beck and various other observers have stressed the fact that fibrosis and organization occur only at the periphery of the hematoma, the central portion remaining fluid.

The chief symptom is pain, of a variable degree, often burning in nature, and not uncommonly transmitted down the extremity along the course of an involved nerve. Pressure of the pulsating hematoma on the surrounding nerves may also produce paresthesia, anesthesia and even in the extreme, paralysis.

The chief signs are those of a brawny mass of variable size appearing at the site of a penetrating or perforating wound. This may, but more often does not, pulsate. A thrill, evidenced during the systolic phase may be felt, but the diagnostic sign is obtained by auscultation when a bruit, occurring during the systolic phase, is audible. This bruit is definite, loud, and may be transmitted distally and proximally along the course of the involved vessel.

It is important to differentiate this mass from a post-traumatic abscess, since a casual incision may end in a disastrous result. Auscultation, and if doubt still exists, aspiration of the tumefaction will definitely determine with what we are dealing. Differential diagnosis of a pulsating hematoma as distinguished from an arteriovenous aneurysm also is necessary, as both the local and systemic effects of the latter differ from those of the former, and the treatment is different. It is my opinion that auscultation is the most reliable early differential point. If the bruit is continuous throughout the entire cardiac cycle, it is evidence of an arteriovenous aneurysm; if it is present only during systole, it is a pulsating aneurysm. There are, however, other differential points which will be described in the discussion of arteriovenuous aneurysm.

The prime concern of the surgeon is whether conservative or radical therapy should be undertaken. The dangers of secondary hemorrhage, due either to erosion or infection, are ever present, and many a restless night is spent in anticipation of just such an occurrence. It would be advisable to act conservatively if the mass were not extensive and extravasation did not cause much discomfort. However, we have had several cases of injury to the

oplitpeal and femoral arteries in which repeated episodes of bleeding did occur and in which the patient complained of severe pain in the involved extremity. It is in these cases that prompt surgical intervention is definitely indicated.

It is necessary to have the patient in optimum condition preoperatively and this is attained by the use of adequate amounts of blood, intravenous fluids, sulfa drugs and penicillin. Complete blood counts and hematocrit readings should be frequently done so that a close check may be maintained on the blood status. The patient should have been typed, and cross-matched blood kept on hand at all times. The primary surgical procedure should be isolation of the involved vessel proximal to the point of injury and the throwing of a tape around it. This will serve as an efficient hemostatic agent if profuse bleeding should occur from the vessel during the operative procedure, and will be a constant source of comfort to the operator. A similar procedure distal to the site of injury should next be undertaken, and then the exploration of the lesion at the site of injury can be performed safely. It will be found that a large amount of clot will have to be evacuated before the arterial lesion can be visualized. In all cases that were explored it was necessary to doubly ligate and extirpate the damaged segments of artery since the lesion was always extensive and repair not feasible. The question of whether simultaneous ligation and removal of a segment of the companion vein should be performed is still a moot one, but we have believed that this is not necessary. As discussed in Nash's Surgical Physiology, exponents of both sides quote facts that show there is no marked advantage in either ligating or not ligating. Studies have failed to prove that by not ligating the large companion vein, stasis, with a fall in blood pressure on the venous side of the system, due to reduction of resistance, will occur and anoxia of the tissues result.

The incidence of gangrene of an extremity after removal of a portion of a major artery is dependent primarily on the state of the collateral circulation, and this in turn is dependent on the amount of tissue destruction which has resulted from the injury. The incidence of gangrene after injury and subsequent ligation of a vessel, and in merely ligating the same vessel without preceding trauma reveals a greater frequency in the former. The following are the figures quoted by Hamilton Bailey:

Artery	Injury and Ligation Per Cent	Ligation Per Cent
Axillary	2.7	1.4
Femoral	20.2	17.2
Popliteal	34.7	26.6

Following the interruption of the blood supply, attempts at improvement of collateral circulation should be made. These procedures include repeated paravertebral blocks with novocain, the use of vasodilators as papaverin hydrochloride parenterally and alcohol per os and the use of external heat, but this latter must be rigidly controlled so as not to exceed 98.4°F.

ARTERIOVENOUS ANEURYSM

This interesting vascular phenomenon was first described in 1757 by John Hunter and was recognized by him for the exact condition that it is now known to us.

When the course of the missile is such that simultaneous laceration of an artery and vein in juxtaposition occur, the result is an arteriovenous aneurysm. A variable amount of blood is spilled into the surrounding tissues and the resultant hematoma may dissect along fascial planes as well as into soft tissue, but most of the higher pressured arterial blood is forced out of the rent in the artery and into the close lying vein to be returned to the pulmonary or portal circulation without ever having passed through the arteriolar and capillary bed.

Because of this shunt and resultant decreased vascular supply to the extremity

distal to the site of injury, local trophic and nutritional changes occur and concomitantly a greater strain is thrown on the heart which is forced to increase its cardiac output since: (1) the pressure head at the site of injury is lowered, and (2) the amount of blood returning to the heart is increased. This is reflected at first by tachycardia, and then by an increase in pulse pressure, cardiac dilatation, hypertrophy, and finally by cardiac decompensation. In addition to these general symptoms are the local symptoms of trauma and pain, of a burning nature, referred down the side of the extremity or along the course of the nerve trunks. In our experience this pain has frequently been severe and continuous necessitating narcotics for sedation.

The signs too are both general and local, the general ones being those of cardiac hypertrophy and finally decompensation. The local signs, which are the most important diagnostically and the first to appear, are a bruit and thrill over the site of injury continuous throughout the entire cardiac cycle. In 1890, an American surgeon, Branham, described a sign consisting of bradycardia produced by manual pressure over or proximal to the tumor. This is of definite aid in arriving at a diagnosis, and, in conjunction with the continuous bruit, is pathognomonic of arteriovenous aneurysm.

Therapy is radical surgery; but unless there is secondary hemorrhage or a rapidly enlarging mass, this is to be delayed for several months until proper collateral circulation can be developed by the body. When surgery is finally performed it is to be done in a bloodless field and a quadruple ligation with removal of the sac is the only procedure to be contemplated. Any other less radical procedure will be found to be worthless and attempts at repair of the arterial defect by the technic of Matas are so different due to the great numbers of vessels which have been developed that it is almost excluded by the technical difficulties. The postoperative results as reported by Elkin at the Army Vascular Center have been excellent.

SECONDARY HEMORRHAGE

No discussion of this topic could be concluded without a brief description of secondary hemorrhage. In our series of cases this was the most frequent vascular accident, and when it occurs is an immediate emergency and demands prompt treatment as bleeding may be so severe that exsanguination soon occurs. The etiology is varied, and the time interval between injury or operative procedure and secondary hemorrhage may vary from a few days to several weeks. The more common etiological factors are (1) slipping of a ligature, (2) erosion due to infection, foreign body, and bone spicule, (3) bleeding from traumatic aneurysm or arteriovenous aneurysm, and (4) contusion of arterial wall with subsequent blow out.

Bleeding may occur only once and be slight or it may be profuse, frequent and severe. The immediate treatment consists of: (1) constant firm pressure over the bleeding site applied manually or with an elastic bandage or by the application of a tourniquet proximal to the site of bleeding, and (2) measures taken to combat shock and collapse if the bleeding is severe. In these latter cases the use of type "O" blood without previous cross-matching is definitely indicated, and it has been our experience on occasions that with very severe bleeding when the red blood cell count falls below 900,000 that typing of the patient's blood becomes impossible.

If bleeding is recurrent, surgical intervention with ligation of the offending artery is imperative. The technic as previously described is to be carried out.

SUMMARY

1. The more common vascular injuries are described and discussed as to etiology, diagnosis and therapeutic procedures.

2. A note of caution as regards the use of the tourniquet is struck, and comment is made as to the advisability of encasing the limb in ice to decrease dangers of misuse, and concurrently facilitate the

readiness with which subsequent operative procedures can be performed.

3. It is advised to employ type "O" blood without previous cross-matching in cases of severe bleeding in which delay in administration of blood would be dangerous.

REFERENCES

1. Bailey, Hamilton. Surgery of Modern Warfare. Edinburgh, 1941. E. & S. Livingston.
2. Beck, W. C. "Pulsating" hematome (false aneurysm). *War Med.*, 4: 502, 1943.
3. deTakats, C. Vascular surgery in the war. *War Med.*, 3: 291, 1943.
4. Elkin, D. and Woodhall, B. Symposium on vascular surgery: combined vascular and nerve injuries of warfare. *Ann. Surg.*, 119: 411, 1944.
5. Elkin, D. Vascular injuries of warfare. *Ann. Surg.*, 120: 284, 1944.
6. Holman, E. War injuries to arteries and their treatment. *Surg., Gynec. & Obst.*, 75: 183, 1942.
7. Holman, E. Further observations on surgery of large arteries. *Surg., Gynec. & Obst.*, 78: 275, 1944.
8. Nash, Joseph. Surgical Physiology. Springfield, Ill., 1942. C. C. Thomas.
9. Pratt. G. Treatment of traumatic and war wounds of vascular system. *Am. J. Surg.*, 57: 26, 1942.
10. Speigel, I. J. and Lewin, P. Tourniquet paralysis. *J. A. M. A.*, 129: 432, 1945.

Aneurysms vary in size from that of a millet seed to a child's head. They may be single or multiple. In order of frequency they involve the thoracic aorta, popliteal artery, femoral artery, abdominal aorta, subclavian artery, innominate artery, axillary artery, iliac artery and the cerebral and pulmonary arteries.

From "Principles and Practice of Surgery" by W. Wayne Babcock (Lea & Febiger).

TRAUMATIC HEMOTHORAX

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PRIOR to the war, opinion regarding the treatment of traumatic hemothorax, was divided among those who believed in the active treatment of aspiration with or without air replacement, and the conservative treatment. The former believed that the blood was a foreign substance which interfered with the cardio-respiratory function and its presence was a danger which might result in excessive adhesions and fibrosis. The conservative group held that aspiration *per se* was a greater menace and was responsible for a larger number of empyemas and that spontaneous absorption of the pleural fluid resulted in the vast majority of cases. The interest of the author was further aroused in the subject in 1941 after observing two cases of debilitating fibrothorax which resulted from traumatic hemothorax treated conservatively.

Does blood in the pleural cavity, in the case of a hemothorax, clot? Dr. Jerome Head in an article[1] stated, "One of the striking and unexplained aspects of the condition is that blood in the pleural cavity does not clot—either in situ or after it has been aspirated." In contrast, Dr. J. M. Clarke[2] said, "The problem of clotting. . . . It is usually stated that massive clotting does not occur in cases of hemothorax, due, it is suggested, to the constant respiratory movement defibrinating the blood. A layer of fibrin is deposited on the pleura and only clots of small size are to be found. There are, however, many exceptions to this general rule, for extensive clotting may occur." I have found large hemothorax cases in which there must have been minimal clotting because they were aspirated with ease. On several occasions, I have aspirated as much as 1,000 cc. of bloody fluid and after straining it, transfused it directly back into the patient without ill effect. On the other hand, all of us have had the experience of encountering the clotted hemothorax in which repeated attempts at aspiration, yielded a few cc. of bloody serous fluid. What are the reasons or causes that produce clotting in some cases of hemothorax and in others it is not apparent?

I believe, that in every case, the clotting process in the pleural cavity is inhibited; but in every case a small amount of fibrin settles on all the pleural surfaces. The blood exerts an irritating action on the pleura which pours out a varying quantity of serum as a defensive measure. This loss of serum is as much a contributory factor in the production of shock in these cases as it is in burns. The inhibition of the clotting process of the blood in the pleural cavity may be due to the following factors: (1) The lack of contact with air; (2) the fact that in the majority of instances the blood in the pleural cavity is from the pulmonary circulation and may possess some anti-coagulant; and (3) the constant commotion set up by the respiratory movements.

The factors that may contribute to the clotting of blood in the pleural cavity in traumatic hemothorax are: (1) The entrance of air into the pleural cavity from a laceration of the lung or from the external wound; (2) a considerable and varying portion of the blood may have originated from the systemic circulation as from an intercostal vessel; (3) contused and injured tissue may have a coagulant influence so that cases of clotted hemothorax are seen where there is more tissue damage particularly associated with fragmentation of ribs; and (4) the presence of bacteria in low grade subclinical infection may hasten clotting. Certainly there is a

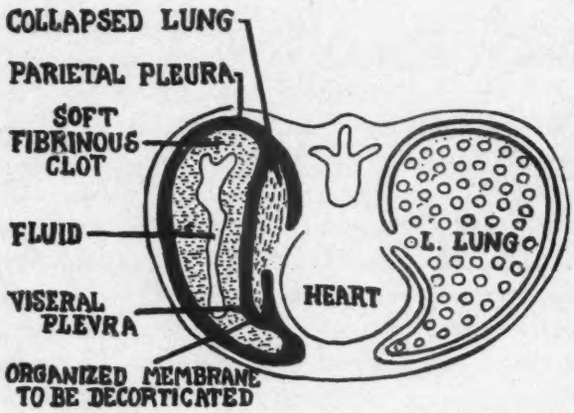

FIG. 1. Cross section of thorax, in clotted hemothorax.

greater amount of fibrin precipitated in the presence of Staphlococcus aureus than in streptococci.

Traumatic hemothorax accompanies all penetrating chest wounds to a greater or lesser degree. The source of the blood is usually from the pulmonary circulation of the injured lung. This type is seldom fatal because the rising intrapleural pressure soon equals that of the low pressure in the pulmonary circulation and the bleeding stops. However, bleeding from injuries to the intercostal and the internal mammary vessels and the large pulmonary vessels at the hilum of the lung, result in massive and sometimes fatal hemorrhage. In addition to the symptoms of hemorrhage and shock, the normal cardiorespiratory physiology is disturbed by progressive decrease in blood volume, cardiac output and vital capacity. There is a progressive resistance to the pulmonary circulation, the heart, and the great veins returning blood to the heart. The clinical picture is too well known to require further comment.

Treatment of hemothorax is directed toward restoring the disturbance of the normal cardiorespiratory physiological state by combating shock, maintaining sufficient oxygenation, increasing the blood volume with blood and plasma, and decreasing the intrapleural pressure by aspirations, until the patient's condition has become stationary at a safe level. Prior to 1943, the prevailing authoritative opinion in the treatment of hemothorax was as follows: (1) Small to moderate size hemothoraces were treated conservatively and usually resulted in spontaneous absorption with little or no sequellae. (2) In large hemothoraces, opinion was divided. Some favored conservative treatment pointing out the frequency of spontaneous absorption and the infrequency of empyema. Others advocated repeated aspirations to hasten recovery and prevent fibrothorax. Still others, advocated aspiration with air replacement after the method of Bastianelli.

In 1943, after the experiences observed in the African campaign, the Surgeon General's Office issued instructions that in all cases of hemothorax attempts should be made to free the pleural cavity of blood by aspirations without air replacement. Air replacement was to be avoided in order to obtain as a rapid a re-expansion of the lung as possible. Cases treated with air replacement resulted often in a pneumothorax with a fixed collapsed lung that subsequently required thoracoplastic procedures.

There were three types of traumatic hemothorax cases that were seen in the forward combat area in the surgical field and evacuation hospitals: (1) The penetrating or perforating chest case with a moderate or small hemothorax, in good general condition. He required little or no treatment beyond a minor débridement of his external wound and an intravenous injection of plasma and was quickly evacuated to a general hospital. (2) The case with a large hemothorax that required supportive treatment with blood transfusion. After a débridement of his wounds he was quickly stabilized by chest aspirations. He was evacuated to a general hospital in about seven days. (3) The patient with a large hemothorax that required supportive treatment with a thorough débridement including a thoracotomy. The surgical treatment in the forward hospitals consisted of thorough débridement of the wound or wounds, excising the skin wounds of entrance and exit, with excision of contused and injured

muscle tissue. Pieces of fragmented loose rib and foreign material were removed. If indicated, the wound was enlarged and the pleural cavity was entered and cleaned of all blood, fibrin or foreign material. Lacerations of the lung were explored and cleaned of clot or foreign material and sutured. If the missile was easily located, it was removed at this time. Hemostastis was made as complete as possible. The pleural cavity was dusted with a mixture of sulfanilamide and penicillin powder and drained with an intercostal rubber tube which was connected to underwater drainage. The wound was closed in layers except the skin which was dusted with penicillin and sulfanilamide powder and covered with vaseline. The tube was removed in three or four days.

At this point, it must be stated that all our wounded were liberally treated with penicillin. It was always plentiful, and treatment was started in forward hospitals and continued in the general hospitals. Many practiced injection of penicillin in varying quantities following chest aspirations. These patients received penicillin pre- and postoperatively and it undoubtedly was responsible for the excellent results in this war. The traumatic hemothorax cases that reached the general hospitals in the communication zone were of four types: (1) The patient that required little treatment such as aspiration of a small or moderate hemothorax or a secondary closure of his wound. (2) the patient with a large hemothorax who required repeated aspirations and supportive treatment; (3) the patient who had had repeated aspirations and now had an infected hemothorax which required a thoracotomy for exploration, removal of a foreign body and drainage. We had six infected hemothorax cases due to Bacillus Welchii, treated successfully with drainage, sulfanilamide, penicillin and serum; and (4) the patient with a clotted hemothorax.

The diagnosis of a clotted hemothorax was never a problem. The involved hemithorax appeared fixed and immobile on respiration. All physical signs of fluid were present. The *x*-ray usually showed a uniform density of the involved hemithorax with a dimunition in its size as evidenced by narrowed interspaces and very often a raised diaphram. Multiple fluid levels were frequently seen and the mediastinal structures were often not displaced. Aspiration of small amounts of blood stained serum was the usual finding. If several attempts at aspiration over a period of three or four weeks failed to show any sign of reexpansion of the lung or absorption of the exudation, a thoracotomy for decortication was indicated.

In the case of the clotted hemothorax, we were faced with the following problem.

We had a traumatic hemothorax of three or four weeks' duration that was not influenced by repeated aspirations. It was feared that a fibrothorax was inevitable. Fortunately, our first case soon after D-day had in addition to a clotted hemothorax a large shell fragment in the right lower lobe. The indication for operation was primarily to remove the large shell fragment. On opening the pleural cavity through a large intercostal incision, the parietal pleura was thickened and the pleural cavity was filled with loculations of bloody serum in the midst of jelly-like reddish yellow fibrinous clots. This was all removed with the gloved hand, sponges, and ring forceps. The lung was found fixed and collapsed against the mediastinum and covered by a dense thick fibrinous exudate. There was no respiratory motion of the lung or the diaphragm, which was elevated and also fixed and rigid and covered with a similar exudate. The costophrenic angle was obliterated. The shell fragment could not be felt. An incision was made through the exudate covering the lung down to the pleura. The lung was seen to balloon through the incision. With the gloved finger and gauze on the end of a clamp, this membranous exudate was easily peeled off the lung leaving a glistening visceral pleura. The entire lung surfaces were cleaned in this manner. The laceration in the lung was

located, cleaned of clot and débris and the shell fragment removed. The laceration was sutured with two rows of chromic catgut. The pleural cavity was irrigated with warm saline solution and dusted with penicillin and sulfanilamide powder. A large size rubber tube was inserted into the pleural cavity through the ninth interspace posterolaterally which was connected for underwater drainage. The thoracotomy wound was closed in layers. Postoperative *x*-ray showed the lung expanded and the drainage tube was removed on the fourth day.

Following the marked success in this case, five additional decortications were performed in England with the same result. In Belgium, we continued to treat clotted hemothorax cases by decortication and performed the operation eighteen times with uniform success. In several cases we had to resort to aspirations of small residual localized hemothorax or to resort to a rib resection to drain a localized empyema. Fortunately, I had the opportunity to see an *x*-ray of the chest of one of the first patients on whom I had performed a decortication in England in June, 1944. In January, 1945, he was admitted to a general hospital in Liege, Belgium, for a hernia operation. He had been returned to active front line duty in November, 1944, and had served through the Battle of the Bulge. The *x*-ray showed a normal chest except for a slight amount of pleural thickening in the right costophrenic sinus.

Opinion was divided in the forward hospitals as to whether it was necessary to drain all thoracotomy cases. We encountered many secondary hemothoraces and empyemas in our general hospital among those that were not drained. This convinced us of the necessity for drainage. It is interesting to find support for this fact in the article by Kay and Meade.[3] The authors had the advantage of studying the cases after their arrival in this country, hence their last period of hospitalization. They found that in 189 patients that had thoracotomies overseas, eighty-one were closed with drainage and 108 without. In those closed with drainage 82.7 per cent healed without requiring secondary operations as compared to 43.5 per cent of those closed without drainage.

Another and very interesting group of figures by these authors illustrates the value of active treatment of hemothorax:

	No. of Cases	No. of Infection	Per Cent
Group treated by thoracocentesis	225	38	16.8
Group treated by operation.....	156	76	48.7
Group treated without definite treatment.....	74	30	45.9

SUMMARY

The problem of hemothorax has been presented from the standpoint of its pathology and management. The results of the experiences encountered in this war have cleared some doubt and uncertainty in regard to treatment and have offered many of us an opportunity to observe the pathology of hemothorax. The mortality and morbidity of chest wounds in this war has been greatly improved in this war by: (1) Excellent early primary surgery in the hospitals in the combat zone; (2) the availability of excellent endotracheal anesthesia; (3) the abundance of the chemotherapeutic agents penicillin and sulfanilamide; (4) the abundance and availability of blood and plasma; (5) the recognition of the value of postoperative endotracheal and bronchoscopic suction.

Active treatment after careful evaluation, in the form of chest aspirations appears to give the best results as compared to conservative treatment. In the case in which bleeding continues a thoracotomy is indicated. In cases of large clotted hemothorax, thoracotomy and decortication offers a prompt return to a normal anatomical and physiological restoration of the involved lung.

REFERENCES

1. Head, J. Hemorrhage into the pleural cavity. *Surg., Gynec. & Obst.*, Oct., 1937.
2. Clark, J. M. The treatment of traumatic hemothorax in war. *New Zealand M. J.*, August, 1941.
3. Kay and Meade. War injuries of the chest. *Surg., Gynec. & Obst.*, Jan., 1946.

THE TRANSVERSE INCISION IN ABDOMINAL SURGERY

A FIVE-YEAR STUDY

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FIVE years ago we decided to undertake a clinical investigation of the various types of abdominal incisions. The conclusions presented here have resulted from our experiences in this study with 480 surgical patients in whom abdominal entry was effected through a transverse or modified transverse incision.

Too frequently the abdominal wall as a surgical entity is stripped of any significance and is regarded only as an ever present barrier to existing intraperitoneal disorders. However, unless this structure is viewed in proper perspective, it's importance may be brought into sharp focus by the occurrence of embarassing and often serious postoperative complications. Often these can be avoided by a careful diagnosis, adequate preoperative care and the use of incisions based on sound anatomical and physiological principles.

There are at least four criteria which a successful abdominal incision must meet. It should: (1) Provide adequate surgical exposure to the operative area; (2) minimize trauma to motor nerves and aponeuroses; (3) afford opportunity for extension of the original incision should this prove necessary; and (4) produce a narrow, firm and sightly cicatrix which is comfortable during convalescence and which affords a degree of ultimate cosmetic satisfaction to the patient.

Reasonings that incisions which meet the above mandates are somewhat more difficult to execute and therefore should be discarded for the simpler and perhaps more conventional technic are pernicious and not in the best interests of the patient.

The merits of a transverse abdominal section cannot fail to be appreciated if it is compared with the anatomical characteristics of the vertical incision.

EXPOSURE

Considering the vertical mode of entry it becomes apparent that operative procedures are usually performed through only one end of the incision. It has been a dictum in pelvic surgery for example, that "an inch below is worth two above." As a corollary Lahey recently emphasized the importance of extending paramedian incisions in the upper quadrants for better exposure to the costal margin. In the latter instance, "an inch above *may* be worth two below." In a six-inch vertical incision only about three inches forms the functioning aperture, the remainder serves merely to enhance its effectiveness. On the other hand, a transverse incision is planned to lie almost entirely over the operative field. The Phannensteil incision affords splendid visualization of the pelvic and lower abdominal viscera, but to attempt upper abdominal surgery through it is sure to produce unsatisfactory results from lack of adequate exposure. The transverse or G. G. Davis appendectomy incision will give excellent access to the cecal area; but if exploration discloses that a hysterectomy is required, we believe it wiser to repair the small initial incision, and then obtain entry, trouble-free, through a better planned one. The point to emphasize here is the particular need for an accurate preoperative diagnosis in which a transverse section is to be employed.

In the technical fulfillment of adequate exposure the disposition of one or both rectus muscles frequently presents a problem to the operator. In any transverse in-

cision, regardless of location or extent, these muscles represent the only structures encountered whose component fibers are perpendicular to the anatomical plane of cleavage. To cut these muscle fasciculi "against the grain" appears at first physiologically unsound. Some authorities emphasize the need for preliminary suture fixation of the rectus muscle to fascia prior to transsection. They state that if this step is not taken, the cut ends of the recti will be released from tension(?) and will retract beneath the fascia, making it impossible to restore their continuity later. Five years of technical experience testify to the profound incorrectness of this statement. Not only do the recti fail to exhibit any elastic properties whatsoever, but during closure of the incision it is entirely unnecessary to approximate the muscle layers. This approximation occurs automatically with closure of the anterior and posterior rectus sheaths. We have not had occasion to reoperate any patient in this group and thus obtain first-hand information as to the ultimate fate of the muscle incision, but animal experiments and the observations of competent investigators show beyond doubt, that fibroblastic proliferation and healing by secondary union produces a new linea transversae.

The decision to retract or divide the recti depends on the degree of exposure required. In all adnexal operations and uterine suspensions, lateral retraction has supplied adequate exposure for us. For hysterectomy the procedure will usually vary with the patient's physique. In a slender individual, we have done total uterine ablation, disposing of the recti by retraction. In the obese, unilateral or bilateral transsection may be indicated and should be performed without hesitation. Transverse upper abdominal incisions should be made at the level of the ninth costal cartilage, and usually one rectus muscle must be severed. The exposure thus afforded is magnificent, much better than that obtained by a vertical incision of similar length.

TRAUMA

In considering this very important topic, a few pertinent anatomical facts may be reviewed with profit. Although the recti muscles lie parallel to the sagittal plane of the body the fibers of the important fascial structures ensheathing them extend in an opposite direction and are morphologically distinct. This fact is easily overlooked because of the intimate connection between these two groups, an affinity most marked between the recti and their *anterior* fascia. Cleavage planes in the fascia of the external oblique, internal oblique and obliquus abdominis transversus are either transverse or slightly oblique, and at the level of the umbilicus their transverse direction is quite apparent. This applies also to the transversalis fascia and the parietal peritoneum. On the basis of this characteristic, Gurd suggested the advisability of making all transverse incisions within two inches of the umbilicus either above or below. There is much to be said in support of this technic based as it is on careful observation and long experience.

Regarding nerve injury, we have always been wary of such trouble in the long paramedian incision, and the closer this incision approaches the linea semilunaris the greater becomes the incidence of this avoidable complication. The cutting of any two adjacent intercostal nerves may devitalize the rectus segment supplied and the muscle atrophies between the incision and the midline, resulting in either a definite hernia, a diastasis or an unsightly asymmetrical bulge. A transverse incision if properly made, affords complete protection against this eventuality because in nearly all cases the line of incision is parallel to the nerve trunks and usually lies between them. In this series we have had not one postoperative hernia or wound disruption.

With regard to blood-vessel injury the picture is considerably different. Many more small arteries and their accompanying veins are severed in performing the

transverse incision. While effecting hemostasis, therefore, a slightly longer period of time is consumed in entering the peritoneal cavity. However, this allows for only minor criticism. The recti may be clamped and cut, and in the lower abdomen there usually will be no vessels requiring ligation within the muscle. The inferior epigastric vessels which lie just external to the parietal peritoneum, gradually become more superficial as they proceed cephalad, finally piercing the deep, internal oblique fascia until their anastomosis with the descending superior epigastric which lies well *within* the body of the rectus muscle. Thus when the recti are incised across the *upper* abdomen these vessels must be carefully searched for in the muscle and ligated, as they can be the source of profound hemorrhage.

ENLARGEMENT

Extension of transverse incisions to produce additional exposure is no problem for within the limits afforded by the costal margins in the upper abdomen and between the pubic rami below there is more than ample room for incisions of sufficient length to allow excellent visualization. It is only when the incision is incorrectly placed too low or too high that bony formations begin to hinder its augmentation.

OPERATIVE SCAR

If the surgeon will carefully analyze, as we have done, the subjective symptoms of patients postoperatively, he will be afforded ample justification for the use of this technic. Closure without tension produces a minimum of discomfort for the patient, and this can be further reduced by maintaining the knees in slight (30 degree) flexion over a small pillow. Straining, coughing or retching, if present, shorten the recti and approximate the edges of a transverse incision; longitudinal incisions are inclined to gape and separate under identical conditions.

Pulmonary atelectasis caused by shallow breathing and poor aeration due to painful incisions is likewise minimized, and within five days the majority of patients become ambulant.

From a cosmetic standpoint the results are ideal. The scars rarely widen beyond the thickness of a scalpel blade even in the presence of soft drains through the incision. In the female patient the location of the cicatrix is such as to allow conformation with fashions exposing the midriff, a feature of no little importance to the fastidious.

REFERENCES

Gurd, F. B. Anatomical principles involved in abdominal incisions. *S. Clin. North America*, pp. 271–275, April, 1945.

Spivak, J. L. Personal communication.

Lahey, F. H. Surgical exposure of the gall-bladder and bile ducts. *Surg., Gynec. & Obst.*, 75: 445–448, 1942.

NON-INFECTIOUS ILIOPECTINEAL BURSITIS

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ILIOPECTINEAL bursitis is not an uncommon occurrence, but apparently it is not commonly recognized in its earlier stages. Since the condition was first described by Fricke in 1834 and elaborated by Joly in 1847, there have been a total of only seventy-three cases reported in the literature. In 1933, O'Connor published a most comprehensive article on this subject in which he added thirty-three cases of his own and was the first author to recognize the condition before a tumor mass presented itself in the groin. In twenty-one of his cases, there was neither swelling nor palpable tumor in the femoral traingle. Three additional cases have been reported since those of O'Connor, but in all three of these rather large tumor masses were present.[3,7] It seems noteworthy that of the seventy-three cases recorded, only twenty-one have been recognized in the acute stage when the most promising results from treatment may be expected.

ANATOMY

The iliopectineal (or iliopsoas) bursa is but briefly mentioned in the anatomical text books. Cunningham says: "The paoas tendon passes over a thin portion of the capsule between the upper ends of the iliofemoral and pubo-capsular ligaments, with a small sub-psoas bursa intervening; sometimes there is an opening in the capsular ligament under the tendon, and the bursa is then continuous with the synovial membrane of the joint." Several anatomists have investigated this bursa. Lund studied eighteen cadavers and found the bursa present in each one. Chandler in his study of the iliopsoas bursa used 206 adult cadavers, five fetuses (five to seven months), ten baby cadavers and twelve stillborn babies. He was able to demonstrate the bursa in all but three specimens. These three were adult bodies. Out of a total of 400 bursae studied, he found that sixty-one (14.5 per cent) communicated with the cavity of the hip joint. Kessel dissected 535 adult specimens and found a communication between the bursa and the joint cavity in 15 per cent. The bursa has been found to vary in size, but as a rule, it averages about 5 to 7 cm. in length and 2 to 4 cm. in width. It extends proximally to the pectineal eminence and may extend over the brim of the pelvis. Chandler concludes that the communicating foramen is not a result of development, but is due to friction of the psoas tendon and also that the bursa exists before birth. (Fig. 1.)

SYMPTOMS AND PHYSICAL FINDINGS

Pain in the hip region, which varies from excruciating to mild discomfort, is usually the first complaint of the patient. This pain may or may not radiate down the front of the thigh to the knee. The patient, or his intimates, will almost invariably notice a change in his gait. Early in the disease, there may be only a shortening of the stride on the affected side as a defense against hyperextension of the hip. Later the extremity will be carried with the hip and knee flexed and the thigh adducted and externally rotated to relieve the pressure of the psoas tendon on the underlying bursa. Fullness or swelling in the groin will not be observed unless other symptoms have been present for several months or longer. Varying degrees of weakness of the extremity was a complaint in over 90 per cent of the cases reported in the literature.

Iliopectineal bursitis is most frequently seen in individuals during the first three decades of life; therefore, a history of trauma, excessive use or repeated strain of the extremity is easily elicited.

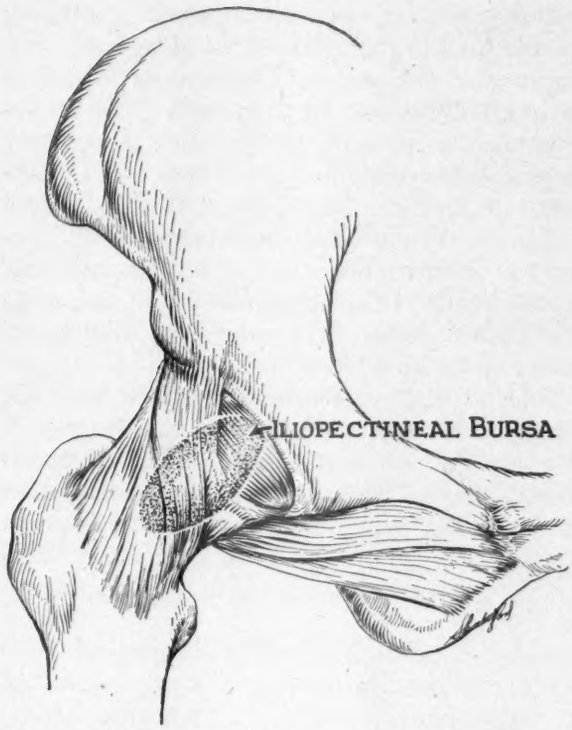

Fig. 1. The iliopectineal bursa is diagrammatically represented to show its direct relation to the hip joint.

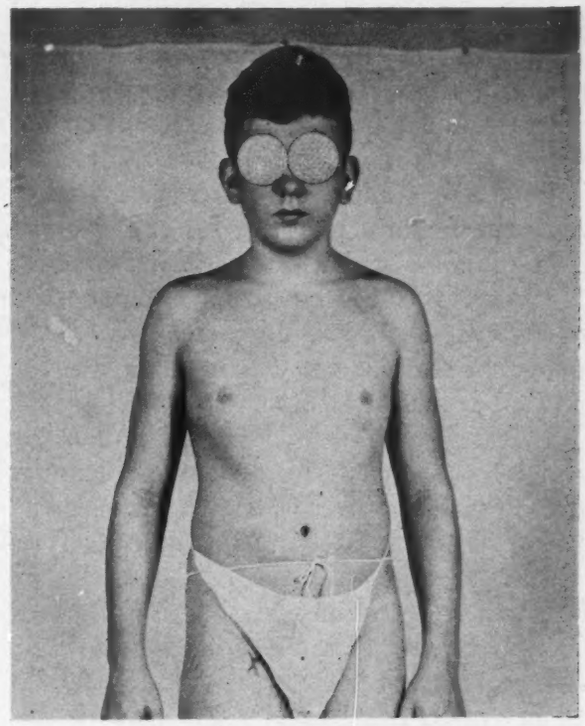

Fig. 2. (Case 1.) X marks the area of tenderness characteristic of iliopectineal bursitis. The right hip is held in flexion with adduction and moderate external rotation of the thigh.

Examination will reveal few but definite physical findings. The hip will be held in various degrees of flexion, and usually in adduction and external rotation. This may be so exaggerated as to produce a marked tilting of the pelvis and apparent lengthening of the affected limb. Pain is elicited by hyperextending, abducting or internally rotating the thigh. Tenderness to pressure over an area about 2 cm. in diameter, just below Poupart's ligament and lateral to the femoral pulse and mid-way between the anterior superior spine of the ilium and the pubis, is a constant finding and may be said to be almost pathognomonic of iliopectineal bursitis. Atrophy of the thigh or tumor of the groin are late findings. (Fig. 2.)

X-ray examination of the hip joint will be negative except in more elderly individuals in whom hypertrophic changes may be noted. It is generally thought that hypertrophic changes in the hip region are a predisposing factor to iliopectineal bursitis and doubtless accounts for its incidence in the older, more sedentary individuals.

DIFFERENTIAL DIAGNOSIS

Iliopectineal bursitis must be differentiated from hip joint disease. Since in intra-articular disease of the hip muscle spasm limits all hip movements and in bursitis adduction, flexion and external rotation can be painlessly accomplished, the differentiation should be easily made.

In late cases with the presence of a tumor mass inferior to the inguinal ligament, cold abscess, perinephritic abscess pointing in the groin, femoral and inguinal hernia, varicosity of the saphenous vein, hydrocele of the cord and lymphodenopathy must be considered in the differential diagnosis.

TREATMENT

Rest is the essential factor in the treatment of iliopectineal bursitis. O'Connor states that without rest other measures are worthless. The application of heat will be found gratifying to the patient and doubt-

less aids in the absorption of fluid and dimunition in the thickness of the membrane of the bursa. Simple bed rest, even with the addition of Buck's extension, does not afford sufficient immobilization. We believe a short hip spica cast with a window over the femoral triangle, for the application of heat, will diminish the period of recovery. It must be borne in mind that even with the most adequate treatment, many weeks will be consumed before the patient is symptom free.

Due to the slow recovery, there arises the temptation to hurry the process by needling the bursa. We cannot recommend this procedure in acute cases; but if resorted to, the surgeon must adhere to strict aseptic technic, bearing in mind that in 15 per cent of the cases, there is a direct communication between the bursa and the cavity of the hip joint.

Surgical removal of the bursa is only necessary in chronic cases of long standing.

CASE REPORTS

One of us (D. C. H.) recalls making the diagnosis of acute iliopectineal bursitis six times during a five-year period in the Army; but since the complete records of these patients are not available, they will not be presented here. We wish to present two cases that are typical of this condition.

Case 1. P. S., a white male, aged twelve, was first seen on December 10, 1945, complaining of mild pain in the right hip region and a marked limp. About three weeks previously, he was injured while playing football and noticed a slight pain in the hip at that time. The father stated that he noticed the boy walking with a shortening of his gait, but attributed it to an affectation. The limp grew more noticeable after one week and an osteopath was consulted. Osteopathic treatments were instituted and continued for about two weeks. The family was then advised to consult an orthopedist.

Examination revealed a well developed boy walking with difficulty. The right hip was held in 30 degrees of flexion, adducted and externally rotated. There was a marked tilting of the pelvis producing one inch apparent shortening of the well leg. Attempts to extend the hip aggravated the pain as did attempts to abduct or internally rotate the extremity. Other movements of the hip could be actively and passively accomplished without pain. There was tenderness to pressure just lateral to the femoral vessels and inferior to the mid-point of Poupart's ligament. There was no fullness nor mass noted in the region. Examination of the spine and other joints and *x*-rays of the pelvis revealed nothing abnormal.

The patient was placed on bed rest with hot applications and diathermy to the hip region for thirty days. There was only slight improvement. He was then placed in Buck's extension and the hot packs continued. After fourteen weeks, the symptoms have completely subsided with a complete range of painless motion in the hip.

Case 11. F. J. M.,* a fifty-six year old white male, employed as a boilermaker, was admitted to the hospital on January 7, 1946, complaining solely of pain in his right groin. The pain had begun suddenly the day before upon arising. He located the pain just below the mid-point of the inguinal ligament and stated that it was aggravated by walking and caused him to limp. There was no radiation to the knee. No history of trauma could be elicited. Past history was of no significance, except five days before admission, he had stuck a nail in the right heel. In February, 1944, he had been admitted to the hospital complaining of backache. *X*-rays of the spine and pelvis were negative at that time.

Examination revealed a middle-aged white male of stenic habitus, apparently in acute pain. His stride was noticeably shortened on the right side and the hip was held in slight flexion. Upon assuming the supine position in bed, the patient held the hip in a position of flexion, adduction and external rotation. Attempts to move the extremity from this position produced severe pain. There was moderate tenderness at the site of pain, just inferior to the mid-point of Poupart's ligament and just lateral to the femoral vessels. Several "shotty" lymph nodes were palpable in the inguinal region, but were not enlarged nor tender. There was no fullness, increased heat or redness. Reflexes were normal.

* This case is presented through the courtesy of Dr. Joe R. Gandy, Southern Pacific Hospital, Houston, Texas.

All laboratory data, including hemogram and urinalysis, were negative. Temperature, pulse and respiration were normal.

The patient was placed on absolute bed rest. He received diathermy to the right inguinal area once daily, sodium salicylate gr. 20 three times daily, and penicillin, 30,000 units, every three hours for a total of 660,000 units. Tetanus antitoxin, 1,500 units, was administered on admission, because of the history of nail puncture. The penicillin was ordered by the intern before the diagnosis was established.

The patient was discharged, improved, from the hospital on January 10, 1946, to be followed in the out-patient department. Pain was elicited on extension, internal rotation and abduction of the hip at this time.

CONCLUSIONS

1. Iliopectineal bursitis must be diagnosed early if complete recovery is to be expected in a reasonable length of time.

2. Its signs and symptoms are definite and the differential diagnosis should not prove difficult.

3. Complete, absolute rest of the part with application of heat is the most efficacious therapy.

4. The location of tenderness in iliopectineal bursitis is so constant and definite that it may be said to be almost pathognomonic of the condition.

5. Needling of the bursa is not necessary in the acute stage of this process.

6. Surgical intervention is only warranted in chronic cases of long duration.

REFERENCES

1. Gatch, W. D. and Green, W. T. Cysts of the iliopsoas bursa. *Ann. Surg.*, 82: 277. 1925.
2. O'Connor, D. S. Early recognition of iliopectineal bursitis. *Surg., Gynec. & Obst.*, 57: 674, 1933.
3. Finder, J. H. Iliopectineal bursitis. *Arch. Surg.*, 36: 519, 1938.
4. Joly. These ingaurole. (Velpeau's Case). Paris, 1847.
5. Chandler, S. B. The iliopsoas bursa in man. *Anat. Rec.*, 58: 235, 1933–34.
6. Fricke, J. I. *Chir. u. Augenkeilk.*, 21: 235, 1834.
7. Stephens, V. R. Cystic tumor of the iliopectineal bursa. *Arch. Surg.*, 49: 9, 1944.
8. Cunningham. Text Book of Anatomy, 6th ed., p. 352. London, 1931. Oxford University Press.
9. Lund, F. B. The iliopsoas bursa. *Boston M. & S. J.*, 147: 345, 1902.
10. Kessel. *Morphol. Jahrb.*, 58: 413, 1927.

BLOOD CELL JEL FOR CHRONIC SURFACE ULCERS*

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THE healing of chronic surface ulcers is one of the most discouraging problems the average physician sees in his office. It is a cause of considerable forced invalidism with its attendant economic loss.

We have developed a preparation called "Blood Cell Jel" at Mercy Hospital, that has healed surface ulcers of the legs. Table 1 shows a break-down of seventy-one cases as treated to date:

TABLE 1

Sex		Age		Blood Type		Etiology		Location	
M	20	20–30	1	AB	3	Varicose ulcers	65	Rt. leg	21
F	51	30–40	11	A	32	Arteriosclerosis	2	Lt. leg	33
		40–50	13	B	10			Both legs	17
		50–60	23	O	26	Traumatic	2		
		60–70	13			Burns	2		
		70–80	10						

Wassermann tests were all negative except for one case, a sixty-two year old female (positive in September, 1945). The Wassermann was negative January, 1945, and October, 1944. No clinical evidence of lues was evident at this time.

The number of treatments required to heal ulcers varied from six to 112. Of all patients treated, seven had recurrences only to heal on repeated Blood Cell Jel dressings.

Moorhead and Unger[1] were the first to report the use of red cells. They used them successfully in the treatment of infected burns and open joint lesions as early as 1942.

Seldon and Young[2] have used dried red blood cells in infected surface wounds, and to quote their conclusions, "The results have not been uniformly beneficial, but are sufficiently promising to warrant more investigation and work along this line."

Our interest in the development of a Blood Cell Jel resulted from a study of the published reports of Murray and Sharr[3] of the Blood Plasma Bank of the Navy Hospital, Philadelphia, Pennsylvania. They made a preparation, using blood cells, tragacanth, and hexalresorcinol, which is applied as a paste to the ulcer areas.

The Blood Cell Jel developed at Mercy Hospital is jelly-like in consistency and is applied by means of a syringe, a technic I shall discuss later in this paper. We have used this preparation for the past seventeen months and are just as enthusiastic about its results now as we were after the first two months it was perscribed.

Writer has used dried blood cell powder,* tyrothricin, penicillin ointment (500 units per Gm.), and two different chlorophyll ointments, one with and one without benzocaine, only to come back to Blood Cell Jel. The latter is well tolerated by every patient which has not been my experience with other preparations used.

PREPARATION OF BLOOD CELL JEL

The availability of blood cells had its beginning at the onset and subsequent days of World War II. Red cross donor centers were sending thousands of units of blood to plasma processing centers with the result that a use for the cellular elements that remained had to be found. The military service were interested only in dried plasma at the time. Hence, dry red cell powder, blood cell paste, and Blood Cell Jel were developed.

* Supplied by Sharpe and Dohme.

* From the Department of Surgery, Mercy Hospital. Read at the Bacelli Medical Club Meeting, January 15 1946, Hotel Statler, Buffalo, N. Y.

The blood cell jel is prepared from blood cells of a recent donor, the type corresponding to the prospective ulcer patient. Plasma is aspirated in the usual aseptic manner, leaving the cellular elements. To this is added the gum suspension base. We have used tragacanth, one of the commonly used commercial gums, as suggested by Murray and Sharr.[3] Experiencing difficulty in getting an unlimited supply of tragacanth, we were advised to try a substitute gum preparation, namely, sodium-carboxymethylcellulose.* It is used exclusively as our vehicle for applying the blood cells to the ulcers.

Methyl-cellulose is soluble in cold water, but insoluble in hot water. When an aqueous solution of methyl cellulose is poured on a glass plate and allowed to dry, it produces a film which is tough, elastic, clear, quite transparent, has good resistance to twisting, and is insoluble in such organic solvents as acetone, ethyl alcohol, methylacetate, benzel and others.

We make an aqueous colloidal mixture by using 5 Gm. of methyl-cellulose dissolved in 95 cc. of distilled water. The mixture is then placed in a water bath at 100°C. for twenty minutes. The sodium-carboxymethylcellulose comes out of solution when heated. However, when the mixture is cooled, it again goes into solution. Twenty-five cc. of a 5 per cent solution of sterile sodium-carboxymethylcellulose is added to 250 cc. of blood cells of the prospective patient's blood type. Murray and Sharr[3] used type O blood in making their paste. We use a jel that corresponds to the patient's blood type, giving us a crimson-red jel. In the past four months we have added 200,000 units of penicillin to each unit (250 cc.) of red cells.

TABLE I

TYPICAL CASES ON HOSPITAL FILES

Name	Sex	Age	Blood Type	Type of Ulcer	Duration	Culture	No. of Treatments to Heal
E. F.	F	50	IV-O	Varicose ulcer of leg	7 wk.	Staph. aureus	51
F. T.	M	55	IV-O	Multiple varicose ulcers of leg	11 mo.	No growth	15
H. L.	F	46	II-A	Varicose ulcers of leg	2 yr.	No growth	24
A. L.	F	74	II-A	Traumatic ulcer of leg	7 wk.	No growth	18
A. R.	M	32	III-B	Varicose ulcer of leg	4 yr.	No growth	6
S. C.	F	56	IV-O	Ulcer along incision for mastectomy	.....	No growth	41
R. B.	F	44	IV-O	Varicose ulcer of leg	.....	Staph. aureus	21
A. M.	F	59	II-A	Varicose ulcers of leg	2 yr.	Staph. aureus	33
C. P.	F	54	II-A	Ulcer of leg	.....	Staph. aureus	14
J. W.	F	72	.....	Varicose ulcers of legs	.....	Staph. aureus	112

Sodium-carboxymethylcellulose is a coarse grey powder and is a cotton-like substance. It forms colloidal aqueous solution and replaces a number of binders, adhesives, and emulsifiers, such as glue, starch, gum tragacanth, and others. It has other advantages: (1) high chemical stability, (2) neutral in aqueous solutions, (3) resistant to acids and bases, (4) stable to light, (5) high emulsifications and dispersive power, (6) good film strength, (7) no tendency to ferment or mildew, and (8) good miscibility.

The technic suggested for the use of the Blood Cell Jel is in three phases. The pretreatment consists of: (1) complete blood count, (2) a Wassermann test, (3) typing of

* Hercules Powder Company, Wilmington, Delaware, supplied the sodium-carboxymethylcellulose used in this clinical study.

blood, and (4) a culture of the base of the ulcer.

The minimum requirements for the application of the Jel are: (1) hospital treatment, (2) all equipment to be sterile, (3) Blood Cell Jel to be prepared and tested for sterility, (4) a syringe (5 to 10 cc.), (5) cotton applicators, (6) vaseline gauze strips, and (7) Abd pads and bandage (two inch).

After treatment consists of: (1) Saphenous ligation performed when indicated, after ulcers are healed, (2) patient is advised to elevate feet (higher than knees) for fifteen minutes three times a day, (3) coco butter is applied to healed ulcer area to keep the scar soft and pliable, and (4) Ace bandage or elastic stockings are worn.

The blood cell jel is kept at 2° to 5°C. and is taken out of refrigeration and immediately applied to ulcer by syringe. It is worked into the ulcer bed by sterile, gauze-tipped applicators. A thick film is applied, after which strips of sterile bandage, three inches by six inches, impregnated with vaseline, are applied and a single Abd pad applied and then the bandage. The dressing is changed daily. As Murray and Sharr[3] reports, I have observed no evidence of Blood Cell Jel on the vaseline dressing or the ulcer twenty-four hours after the dressing was changed, indicating that it was completely absorbed. A few typical cases taken from our files are shown in Table 1.

CONCLUSION

1. This paper confirms the observations and findings reported by Lieut. Murray and Capt. Sharr[3] at the Blood Plasma Bank of the Navy Hospital, Philadelphia, and presents our experience with seventy-one cases of chronic surface ulcers over a period of seventeen months.

2. Sodium-carboxymethylcellulose is now being used exclusively as a matrix for our Blood Cell Jel. In infected cases, the discharge decreases, and the patients with severe pain secure relief much sooner than with any other preparation. We ascribe this to the film affect of the sodium-carboxymethylcellulose.

3. I give the Blood Cell Jel therapy to the ulcer patient, using the corresponding blood type.

4. Blood Cell Jel apparently adds needed protein and nutritional elements needed to heal surface ulcers.

The writer is grateful for the efforts of H. J. Dancy, chemist, and Phillip Smyntek for their assistance in obtaining sodium-carboxymethylcellulose. The success of this problem would have been impossible without the untiring efforts and enthusiasm of Sister Mary Gertrudis and Sister Mary Marcella, of the Laboratory Department, and Sister Mary Vincentia, of the *X*-ray Department.

REFERENCES

1. Moorhead, J. J. and Unger, L. J. Human red cell concentrate for surgical dressings. *Am. J. Surg.*, 59: 104–105, 1943.
2. Seldon, T. H. and Young, H. H. Use of dried red blood cells in wound healing. *Proc. Staff Meet., Mayo Clin.*, 18: 385–389, 1943.
3. Murray, C. K., and Sharr, C. M. Red cell paste treatment of ulcers and chronically infected wounds. *J. A. M. A.*, 125: 779–782, 1944.
4. Habelmann, G. Survival time of transfused leukocytes. *Bull War Med.*, 3: 392, 1943.
5. Seldon, Thomas H., Lunday, John and Adams, R. Charles. Stimulation of wound healing, a new use for powdered blood cells. *Anesthesiology*, 5: 566–573, 1944.

DIAGNOSIS OF THENAR SPACE ABSCESS*

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ABSCESS of the thenar space is not usually followed by the severe local morbidity so often seen with the more common lesion of tenosynovitis. Much of the dread of septicemia has waned since the advent of effective bacteriostatic agents.

Nonetheless, significant limitation of motion of the thumb, especially that component controlled by the adductor pollicis muscle, will be encountered in direct proportion to the delay in drainage of the space. For maximal recovery of function of the hand, it is obvious that early drainage must be performed.

However, the non-localized infections of the base of the thumb, such as cellulitis and lymphangitis, will not be improved by incisions, and, if such errors of interference are made, the consequences of possible inoculation of the thenar space must be expected, as well as the risk of blood stream dissemination of the organisms. The greatest unnecessary local risk will be assumed when the probing clamp enters a normal space because the presence of pus has been suspected erroneously. Following such a maneuver the tear in the fascia overlying the adductor muscle rapidly heals, but the organisms have been implanted in an excellent culture medium. The stage has been well set for the development of a subsequent abscess. I have seen two patients whose space had been opened in search of pus which did not exist at the time, but who developed a severe space infection within a few days. In both cases a cellulitis had been incised because the surgeon had believed that a deep abscess was also present.

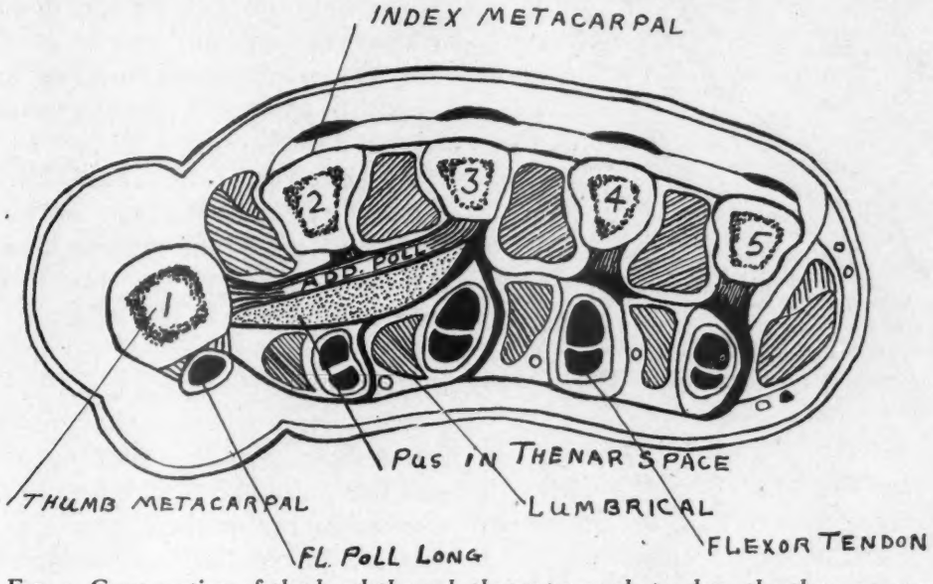

FIG. 1. Cross section of the hand through the metacarpals to show the thenar space distended with pus.

Reference to Figure 1 will show that the thenar space, which lies between the adductor pollicis posteriorly and its overlying fascia anteriorly, is very deeply placed in the hand. Direct examination is thus not possible because the area is covered posteriorly by the dorsal interosseous muscle of the index finger and

* From the Surgical Service, Gallinger Municipal Hospital.

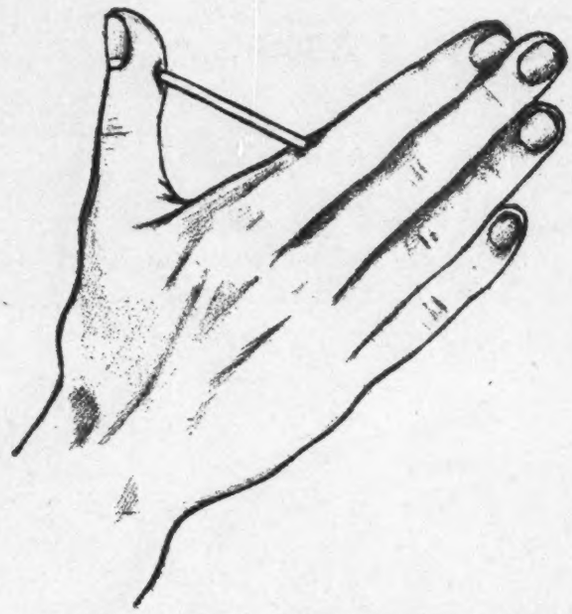

FIG. 2. The test, as described in the text, is performed by asking the patient to attempt adduction of the thumb, such adduction being prevented by a match held between the thumb and index finger.

anteriorly by the other short muscles of the thumb. It is obvious that the diagnosis, therefore, must be one of inference.

The clincial picture of swelling, pain, tenderness, pain on motion of the thumb and broadening of the web space between the thumb and index finger is suspicious of the presence of the lesion. However, it is a matter of clinical fact that this same syndrome may be presented by any tense inflammatory edema, e. g., cellulitis or lymphangitis, involving the base of the thumb. The diagnosis is made still more complex when the infection is a combined form, a not infrequent finding.

In an endeavor to add more accuracy to the clinical diagnosis of this condition, existing either alone or in association with other inflammatory lesions of the hand, the following test was devised:

The patient's hand is placed palm downward on a flat surface to avoid use of the opponens muscle. An object is placed between the thumb and index finger of such size that approximately equals the natural distance between them. For this purpose an ordinary kitchen match is convenient and satisfactory, and can be easily broken into the desired length. The patient is asked to attempt approximation of the thumb to the index finger by pressing against the end of the match. This action is effected by the contraction of the adductor pollicis alone. If the muscle is overlain by pus, contraction of the muscle will cause pain in the base of the thumb. This pain occurs whether there is or is not actual motion of the metacarpal. In this test, practically no motion occurs, thus avoiding compression or stretching of the other soft tissues of the thumb base. In this way, the adductor pollicis and its overlying fascia is tested as a separate structure. The tender tissues of a lymphangitis or a cellulitis will undergo practically no stimulation during the test, and if either of these conditions is present without concomitant thenar space infection, the pain, so agonizing in intensity with thenar space abscess, will be either absent or minimal. (Fig. 2.)

In six cases of thenar space abscess, proven by operative findings, this test has been consistently positive. In no patient in which this test has failed to provide the expected results has there been subsequent demonstration of thenar space infection.

Case Reports

CARCINOMA OF THE CECUM IN ASSOCIATION WITH ACUTE APPENDICITIS

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THE finding of cecal malignancy in conjunction with acute appendicitis is unusual. It is true that cancer of the cecum often gives rise to symptoms suggesting "chronic appendicitis" and less often simulates the picture of acute appendicitis, but the definite association of the two conditions in an intimate pathological relationship has been demonstrated very infrequently. On the other hand, considering simply the mechanics which are involved, one would not expect the association of these two conditions to be so rare. Yet, it is, and in four representative studies[1–4] of malignancies of the cecum and ascending colon, no instances of the coexistence of malignancy and acute appendicitis are recorded. Erdman and Clark[1] studied forty-eight cases of cecal malignancy and do not mention the finding of acute appendicitis at all. Lahey[2] reviewed the cases at his clinic in 1939 and mentions no such association. Chamberlain[3] studied forty-one cases of cecal carcinoma with no accompanying appendiceal inflammation and Mayo and Lovelace[4] went over the 885 case histories of all the cecal and ascending colon malignancies at the Mayo Clinic for the period 1907 and 1938, and described no instance of intimate relationship between the growths and inflammation of the vermiform appendix.

Repeatedly, Charles W. Mayo has stressed in talks and in articles the necessity for examining the cecum at the time of appendectomy. He lays particular stress upon those cases in which the appendix is removed in an "interval stage" or where it is found to be not acutely inflamed. A certain number of patients having had such operations show up with carcinoma of the cecum within a relatively short time afterwards, and the conclusion is obvious that the operator at the time of the appendectomy failed to evaluate carefully the cecum and ascending colon. It is our belief that a similar checkup should be made when one finds acute appendicitis especially if there be any suggestion of a mass present in the lower cecum. It is not advocated that the patient be subjected to an intra-abdominal exploration which would tend to spread contamination from the obviously inflamed appendix but it is urged that the available portion of the cecum be carefully scrutinized and palpated and the biopsies be taken as indicated. With the belief that more malignancies of the cecum could be found even in association with acute appendicitis, it is considered worth while airing this general subject at the present time.

The association of cecal malignancy and acute appendicitis has appeared as a subject entity in the literature but the writings on this association of pathologies is scant and spotty and seems worthy of review and correlation. One more case is reported here and added to the small total. A discussion of the subject is included covering the associated pathologies, the possibility of preoperative suspicion and the problem of diagnosis at operation. The question of what is proper treatment and when it should be instituted is also covered.

While Beran[5] reported a case of cancer of the cecum associated with appendiceal

abscess in 1919, it was really Morton, of England, who first entered into a discussion of the whole problem.[6] In a case report by Muir,[7] obstruction by a cecal cancer caused appendiceal inflammation and mucocele formation. Quoting from what may have been a personal communication (since the reference could not be traced), Muir writes as follows: "Wilkie has pointed out that acute appendicitis may be the first indication of this disease (carcinoma of the cecum)." Mayer[8] reported three cases of acute appendicitis in association with bowel malignancy, one of which followed the course more typical of those in other reports. Parker and Rosenthal,[9] cite one typical case of cecal carcinoma and acute appendicitis in which the carcinoma of the cecum invaded and obstructed the base of the appendix, giving an obstructive gangrenous appendicitis with rupture for which operation was performed and drainage instituted. The draining sinus persisted and the malignancy spread to and involved the ileocecal valve giving rise to a subsequent obstruction. Secondary operation revealed the true status of the conditions present. Another case is also reported which was almost identical with one of those reported by Mayer. It was one in which acute appendicitis was found in conjunction with an obstructing malignancy of the transverse colon. As late as 1935, Banks and Green[10] made the statement that in the literature they were able to find but three papers on this subject, the one by Mayer, the one by Parker and Rosenthal and another by a French author named Shears[11] whose article is not available to this writer. The immediate authors add another case of their own. Also in 1936, Cooke[12] reports one more case which is a rather typical one. The patient had an acute episode of abdominal pain and was found to have an abscess in the appendiceal area. This was drained and continued to drain for a period of eight months. At this time a mass was palpable and the patient was re-operated upon. The appendix was apparently completely digested for it was not found at the second operation; a cancer of the cecum was present, however. The involved tissue was removed and an ileotransverse colostomy done. A local recurrence was noted a year and one-quarter later in the abdominal wall at the site of the sinus tract. In 1938, Seegers[13] reported three cases of carcinoma of the cecum, their clinical course resembling that of appendicitis and in the same year Speese and Bothe[14] reported two cases; the one case showed a rather typical association of acute appendicitis plus cecal carcinoma but in the other, no acute appendicitis was found, although there was every preoperative indication that it was present. The subject was again discussed in an article by Bartlett and Miller[15] in which acute appendicitis is regarded as a "complication" of carcinoma of the cecum.

Three excellent references which have a bearing on one aspect of the subject, namely, the question as to whether carcinoma at the base of the appendix is cecal or appendiceal, are given as follows: Young and Wyman,[16] Uihlein and McDonald,[17] and Chomet.[18]

Throughout the scant literature on this subject, there appears to be a few common denominators: (1) An acute attack suggesting appendicitis in an individual in whom no suspicion of malignancy exists; (2) abscess formation in the appendiceal region; (3) failure to identify the presence of a neoplasm at the primary operation; (4) a persistence of the draining sinus beyond normal expectancy, and (5) the feeling of a mass near the lower cecum.

Sifting out of the case reports those in which the malignancy was further along in the large bowel than the cecum or in which there was some other reason to doubt that the intimate association of cecal cancer and acute appendicitis existed there remain eleven instances of this association. The articles by Wilkie (as quoted by Muir[7]) and Shears[11] were not available.

CASE REPORT

A twenty-three-year old, white male first noticed abdominal pain June 10, 1944. This

Fig. 1. *X*-ray taken September 1, 1944, showing what appears to be extrinsic pressure upon the lower portion of the cecum and adjacent small bowel, giving a distorted outline of these parts. In the center of the infringing mass is a small calcified area.

Fig. 2. A later appearance of the bowel on the same day, September 1, 1944, showing the persistence of the deformity in the lower cecum and adjacent bowel, apparently from extrinsic pressure. One shadow in the small bowel seems to demonstrate the Meckel's diverticulum unsuspected at this time but later found at operation.

centered at first in the lower abdomen just below the umbilicus but moved very promptly to the right lower quadrant and remained as a sharp, steady, moderately severe pain until the night of June 12, 1944, when the pain was so severe it interferred with sleep. On the next day the patient was hospitalized. The pain did not radiate although the patient occasionally felt an isolated sharp twinge in the region of the heart on deep breathing. There had been loss of appetite and slight nausea since the onset of pain but no vomiting. The bowels moved daily and stools were well formed. There was no dysuria.

The patient enjoyed good health previously except for an alleged attack of appendicitis in childhood. The family and social history contributed nothing.

Physical findings on abdominal examination were described by the examiner as follows: "There is moderate tenderness in the right lower quadrant about at McBurney's point and there is a smooth, rounded, tender mass palpable in the right lower quadrant. Rebound tenderness is referred to the right lower quadrant."

The diagnosis of an acute appendicitis was made and on June 13, 1944, the day of admission, and the patient was operated upon. The operative note is as follows: "Abdomen was prepared with Tincture of Merthiolate, opened through McBurney incision. There was a small amount of clear fluid present. The cecum could not be delivered. The appendix could be palpated lying retrocecally and felt to be 2 cm. in diameter by about 7 cm. in length. The organ was entirely retroperitoneal, not even a trace being visible. An attempt was made to mobilize the cecum and expose the appendix but the tissues were so acutely infected and so friable that it was felt to be better judgment simply to drain the appendiceal region. Drainage was established with cigarette drains, one in the pelvis, one in the lateral gutter, one in the retrocecal portion, where mobilization had

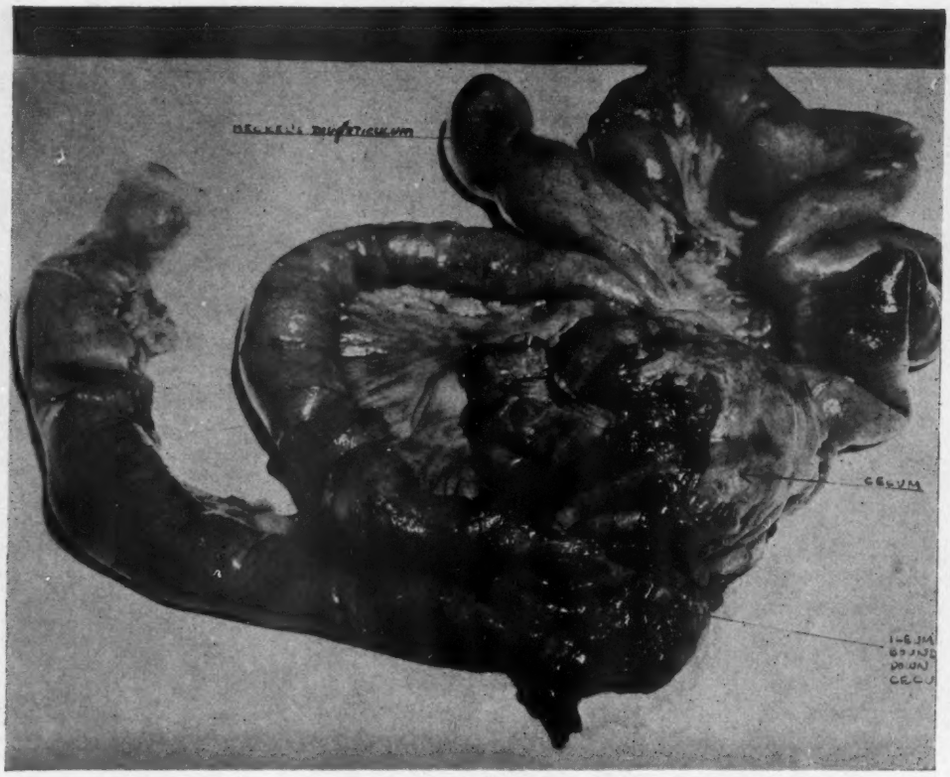

FIG. 3. Photograph of specimen unopened showing mostly the numerous adhesions of the small bowel to the cecum, the fullness of the lower end of the cecum and the absence of any remains of the appendix. Meckel's diverticulum is clearly shown.

been started. Wound closed about the drain in layers."

The operation lasted one hour nine minutes. Anesthesia was a spinal, 150 mg. of procaine hydrochloride being administered.

The patient's recovery after operation was prompt and his general condition was good. Drains were removed on the fifth day. As his convalescence progressed, he complained of continued pain in the lower right quadrant and a palpable mass was still extant there. The draining sinus persisted. This status continued for approximately two and one-half months when he was transferred to this hospital.

Upon examination here, the patient was found to be in excellent general condition and the only positive findings were the scar of his previous operation, a draining sinus within it and a palpable mass deep in the lower right quadrant beneath the scar. This mass was firm and seemed to be fixed to the undersurface of the abdominal wall.

Laboratory examinations gave findings within normal limits including hemoglobin values, ethrocyte counts and urinalyses.

X-ray of the gastrointestinal tract (Figs. 1 and 2) was reported as follows: " . . . Subsequent observation at 2, 3, and 4 hours shows a filling defect from what appears to be an extrinsic lesion in the right lower quadrant. This displaces the cecum and terminal ileum upward and 2 or 3 other loops of ileum medialward. In the center of this defect is a small irregular oval shadow about 1.5 cm. having the density of calcium. This may possibly represent a foreign body reaction. Impression: Chronic granuloma in the region of the cecum."

It was believed that the patient had an ample opportunity to heal his sinus tract. The possibility that it was being perpetuated by some foreign body at the base of the tract was taken into consideration and a decision was made to open the abdomen and investigate. This was done on September 4, 1944. The operative report of this procedure reads as follows: "A four-inch right rectus incision was made, centered 1½ inches below the umbilicus and 1½ inches to the right of it. On opening the peritoneal cavity, the cecum was found to be tightly bound to the lateral and posterolateral abdominal wall. Loops of small bowel were attached to the cecum by recent but well established adhesions. These adhesions were severed and the small bowel separated from

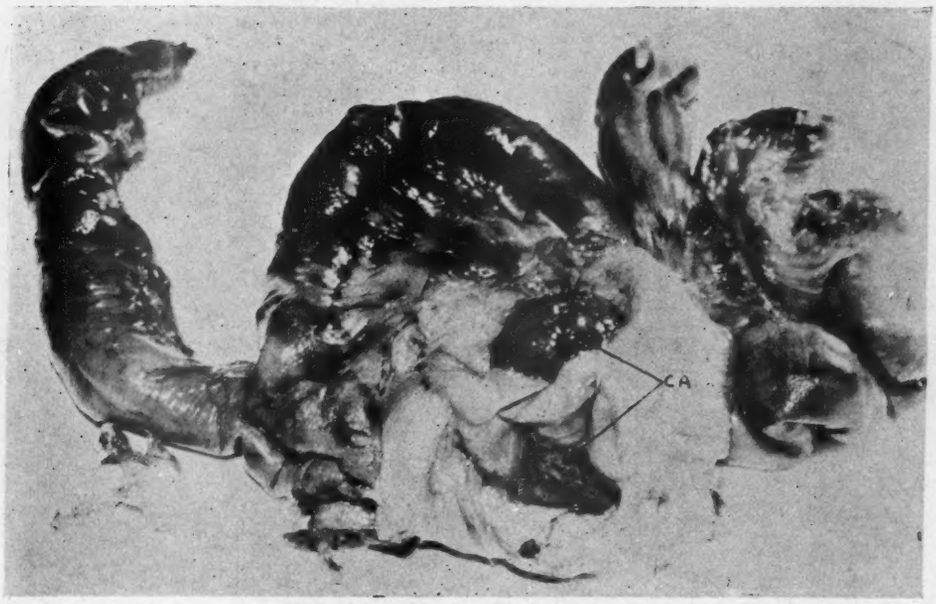

Fig. 4. Cecum open shows the malignant mass to be at the lower portion of the cecum near where the appendix presumably joined it.

the cecum. It was impossible to bring the cecum up without breaking into the chronic inflammatory fibrous tissue which bound it to the abdominal wall. Separation of the cecum from the parietes was begun and carried on gradually. Very firm and even calcareous fibrous and chronic inflammatory tissue was encountered. Pieces of this very firm tissue were taken for microscopic examination. The cecum was not opened during the freeing process but its undersurface was quite raw when it was finally dislodged. No remains of the appendix could be identified despite the fact that the area where it might be expected was well exposed. The raw surface of the cecal wall was closed over with '00' plain catgut sutures. A cigarette drain was placed in the operative area and brought out through the lower angle of the wound. The abdomen was then closed in layers."

Following this operation the patient had a somewhat stormy convalescence with drainage from the new wound. He gradually improved, however, and after approximately four weeks, the draining sinus had healed over as had also the original sinus.

The report from the pathologist on the sections submitted was most interesting. "Histology: Histological examination of wall of specimen sent in from the operation reveals an infiltration in all of alveolar gland composed of a single layer of columnar epithelium resembling intestinal mucosa. They are growing without a definite pattern in a connective tissue stroma which is infiltrated with lymphocytes. Although this represents a definite malignancy, it is of low grade pathologically since the alveolar structure is well maintained throughout. Some of the glands secrete mucous. Diagnosis: Adenocarcinoma of intestine, probably colon."

On the basis of these findings another operation was unquestionably necessary. Some time was allowed for further convalescence and general up-building and included a furlough home since the man's morale was somewhat low. This delayed the direct action upon the malignant growth but it was time well spent for when the patient returned he was in good spirits, had gained weight and the abdominal wall was free of any residual infection. The preoperative checkup revealed normal findings for blood count, hemoglobin, plasma protein level and blood chemistry. The bowels moved normally every day and he never had any indication of change in bowel habit nor had blood ever been detected in the stools.

On November 16, 1944, (five months after the first admission for "acute appendicitis") a third operation was performed. The description follows: "With the patient under anesthesia, palpation of the abdominal wall and through it the abdomen itself revealed a mass in the lower right quadrant approximately $2'' \times 3''$ in measurement. This was firm and fixed. The abdomen was opened through the

FIG. 5. Microphotograph (× 125) represents the more adenoid portion of the tumor showing irregular large mucus secreting glands with some loss of polarity of nucleii and piling of cylindrical epithelial cells. Some of the tubules show cystic distention.

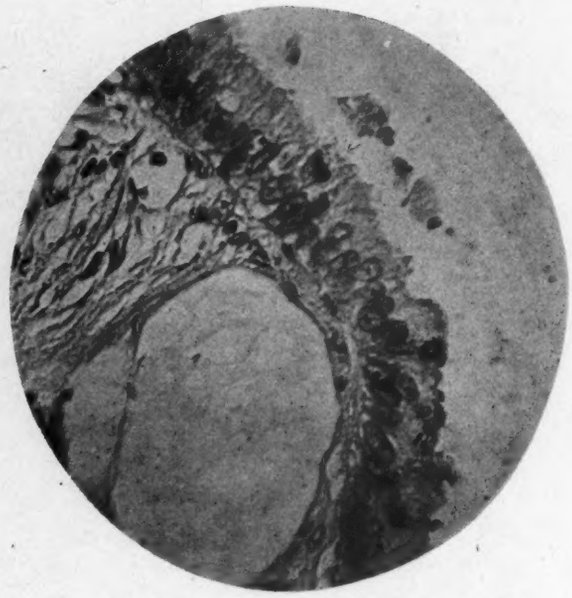

FIG. 6. Microphotograph (× 600) shows typical secreting cylindrical cells that line some spaces; the dark band-like nucleus (indicated by arrow) is a mitotic figure removed from normal position against the basement membrane. Other space filled with thin mucin has lost its epithelial lining.

previous right rectus incision and after omental adhesions were freed, the bowel in the lower right quadrant was seen to be tightly bound down. Hard tissue was palpated in the region of the lower cecum and in the mesentery nearby, nodules were felt. Small loops of bowel bound in the mass were freed and the mass seemed to involve the cecum. This was fixed to the adjacent structures and separately to the anterolateral abdominal wall. The liver was examined and found to be normal; there were no nodules in it. Firm and hard glands were present in the mesentery, both adjacent to the mass and beyond the immediate vicinity of the same. The cecum with its contained mass was gradually freed from the tissues in contact with it. The process of freeing was a tedious one and it was impossible to separate the mass completely from the posterolateral peritoneum and abdominal wall. In order to mobilize the cecum, the peritoneum and part of the muscle tissue of the abdominal wall was incised in an encircling manner and brought away with the mass. Elevating the lower portion of the cecum, the iliac vessels and ureter were separated from it. The small bowel proximal to the cecum was traced backward and a Meckle's diverticulum found bound deep in the pelvis. Going distally from the mass, the ascending colon seemed free of involvement in its upper portion. The bowel was divided through the transverse colon near the hepatic flexure and again approximately 4′ proximal to the ileocecal junction. The portion between, including the mass, was removed. Both ends of the bowel were closed in and a side-to-side ileotransverse colostomy done. Prior to the anastomosis all suspicious glands were dissected out and that portion of the abdominal wall which was about the old sinus tract leading down to the mass was excised in toto. Sulfanilamide powder was dusted onto the bowel. A cigarette drain was placed in the area and brought out through the opening made by the excision of the sinus tract. The abdominal wounds were closed by through-and-through sutures of #10 crochet cotton."

For a day or two there was some drainage of serum and blood from the wound but the patient's recovery was rapid and most satisfactory. He was passing gas within five days and had a bowel movement on the seventh day. Both abdominal wounds were completely healed within two weeks.

A report on the tissue examination dated November 30, 1944, reads as follows: "There is a large Meckle's diverticulum 6 cm. in length and 2 cm. in diameter. This shows no inflammation or ulceration. A portion of the ileum is adherent to the cecum by old adhesions and in

intimate contact with a large tumor mass the size of a small apple. (Fig. 3.) On the serosal side it is covered by a fibrous tissue adhesion. On the mucosa side it shows two fungating protrusions into the lumen measuring each approximately 3 cm. in diameter. (Fig. 4.) The section through the tumor mass reveals it to lie in the mucosa and submucosa. However, section into the mass of fibrous tissues by which the ileum is bound to the cecum reveals an infiltration of malignant tissue throughout this area. Tumor is somewhat gelatinous on section suggesting colloid type of malignancy. There are four regional lymph nodes included with the specimen. Only one of these is enlarged and is found to contain a dense white indurated tissue resembling malignant tissue. The others also show this same type of tissue. There are no implants of carcinomatous tissue visible on the free portions of the ileum or its mesentery. Histology: Histological examination of the mass and the regional lymph nodes reveals a similar picture in each. In a fibrous stroma infiltrated with lymphocytes, there is a growth of atypical glands lined by columnar epithelial cells. These show pleomorphism and mitotic figures. Atypical large round cells with rounded eccentric nuclei characteristic of colloid type of adenocarcinoma are also seen and atypical gland spaces are filling with stringy basophilic mucus. Diagnosis: Colloid adenocarcinoma of the cecum with metastasis to regional lymphnodes." (Figs. 5 and 6.)

The soldier made a complete recovery from this operation and was soon able to eat a regular house meal. His bowels moved daily and he gained weight. *X*-ray examination of the bones and chest showed no evidence of any spread of the malignancy and after a two months' convalescence, he was discharged.

Fig. 7. This microphotograph shows tumor infiltrating the skin. Skin is to the right; tubules of tumor cells seen invading dermal papilla via lymphatics. In derma and subcutaneous area to the left are spaces filled with mucin; occasionally, a tubule of tumor was seen and in some of the smaller spaces are loosened islands of secreting tumor epithelial cells.

COMMENT

The discussion may be introduced by quoting from the article by Uihlein and McDonald[17] in which they describe three types of carcinoma of the appendix, the last of which is that type "which resembles both grossly and microscopically those found in the colon and which will be referred to as the colonic type." Speaking further of this colonic type of appendiceal carcinoma they state, "Because of their frequent location in the base of the appendix, obstruction to the appendiceal lumen usually results early in the course of the disease. As a consequence, acute appendicitis usually with perforation is a common occurrence." While the cases which are under discussion in this paper are not carcinomas of the appendix, still the location of a carcinoma in the cecum in many instances will result in the same mechanical blockage of the lumen of the appendix, either by direct impingement or by the impingement of secondary inflammatory swelling. One other point should be mentioned in the possible etiology of acute appendicitis and that is the rôle of infection. Should the surface of the carcinoma become eroded, certainly an entrance is furnished for bacteria which may make their way to the tissues in the walls of the adjacent appendix and thus contribute to if not precipitate the attack of acute appendicitis. In any event the most likely possibility as far as the carcinoma precipitating an attack of acute appendicitis goes, is the one of obstruction of the appendiceal lu-

men. It is not entirely out of the realm of possibility, however, that a certain number of these patients simply develop simultaneously an attack of acute appendicitis in the presence of a carcinoma in the adjoining cecum.

An interesting sidelight and again possibly explained by blockage of the appendiceal lumen by the growth or its attendant inflammation, is the fact that certainly in one case as described by Speese and Bothe,[14] a carcinoma of the cecum may give convincing signs and symptoms of acute appendicitis when none is actually present. The convincing picture in a case like this could undoubtedly be due to a temporary distention of the appendiceal lumen with retained gas without the organ actually going on to a state of inflammation.

In our own case, the proximity of the growth to the appendiceal lumen certainly suggested obstruction as the underlying etiological factor.

As to diagnosis, it is almost impossible to diagnose the presence of the two lesions preoperatively. If the attack were to come on in a patient with preceding classical signs and symptoms of a malignancy in the cecum, it might be possible to arrive at an accurate diagnosis. Usually these co-lesions have occurred in rather young individuals in whom the presence of a malignancy has not been suspected. Diagnosis with the abdomen opened is difficult enough in the presence of the acute inflammation in and about a gangrenous appendix. In the case here cited the appendix was apparently thick, acutely inflamed and completely retrocecal and the picture very confusing. It is very difficult to tell whether the swelling and firmness in the adjacent structure of the cecum is due to a neoplasm or whether it is simply a continuity of an inflammatory reaction. If the presence of malignancy is suspected, certainly a biopsy of nodes, appendages or even possibly of the bowel wall itself is indicated. Should an abscess be present, the diagnosis is even more difficult, for the operator feels restricted in his investigations within the abdomen. In cases of longer standing, the clue is the persistence of the drainage and the chronicity of the sinus tract; also as in our own case, the presence of a mass may be detected later deep within the abdomen usually at the base of the sinus tract. Even with this picture it must be recognized that sinuses following appendiceal abscesses in which the appendix or part of it is allowed to remain in the belly, persist for a long, long time whether a cancer be there or not. One is faced with the decision as to whether he should or should not open the abdomen to investigate the situation and again when such investigation is most desirable. Certainly, a period of time should be allowed to elapse in order to permit what infection is present to become as inocuous as possible. Upon this secondary investigation one may not be able to tell grossly that he is dealing with a malignant mass, as was true here. Again, in this present case the presence of a calcification suggested very strongly a marked chronic inflammatory reaction which undoubtedly was also present, but in addition, the patient had a malignancy of the cecum. Frozen sections would be of great help in such contingencies.

As far as the operative treatment goes, two fundamental things need to be done: First, the involved bowel and adjacent lymph nodes should be removed as completely as possible and bowel continuity restored. In the second place, the contact portion of the abdominal wall plus the tissue surrounding the sinus tract should be removed *en bloc*. The need for this is well demonstrated in our present case in which sections taken from along the sinus tract showed a creeping towards the surface of the malignant epithelium. (Fig. 7.) Unless one is dealing with a badly infected area, the one-stage ileotransverse colostomy, following the removal of the involved portion of the bowel, is desirable.

SUMMARY

1. The literature on the subject of carcinoma of the cecum in association with

acute appendicitis has been reviewed and a total of eleven cases found therein. One more case is added.

2. The common succession of events is: (1) Signs and symptoms of acute appendicitis in an individual unsuspected of harboring a malignancy; (2) appendiceal rupture and abscess formation; (3) drainage of the abscess without recognition of the presence of cecal cancer; (4) failure of the resulting sinus to close, and (5) the feeling of a mass in relation to the lower end of the cecum.

3. Diagnosis preoperatively is almost impossible. Diagnosis at operation rests on suspecting the possibility of the presence of a growth, carefully examining and evaluating the available portion of cecum and finally taking tissue for microscopic examination when indicated.

4. Resection of the affected portion of bowel, the tissue in the "contact" part of the abdominal wall and the tissue surrounding the sinus tract should be done. A primary ileotransverse colostomy restores bowel continuity.

REFERENCES

1. Erdman, J. F. and Clark, H. E. Tumors of the cecum, discussion and report of 48 cases. *Amn. Surg.*, 85: 722–31, 1927.
2. Lahey, F. H. Neoplasms of cecum and ascending colon. *Am. J. Surg.*, 46: 3–11, 1939.
3. Chamberlain, D. T. Cancer of the cecum. *S. Clin. North America*, 21: 837–49, 1941.
4. Mayo, C. W. and Lovelace, W. R., Jr. Cancer of the cecum. *Surg., Gynec. & Obst.*, 72: 698–706, 1941.
5. Beran, A. D. Cancer of the cecum and appendiceal abscess. *S. Clin., Chicago*, 3: 331, 1919.
6. Morton, C. A. Differential diagnosis of malignant disease of cecum from chronic and subacute appendicitis. *Bristol M. C. J.*, 39: 82–90, 1922.
7. Muir, J. B. G. Mucocele of appendix caused by early carcinoma of cecum. *Lancet*, 1: 131, 1931.
8. Mayer, F. O. *Zentralbl. f. Chir.*, 54: 261, 1932.
9. Parker, G. E. and Rosenthal, D. B. Cancer of the cecum as direct cause of acute appendicitis and simultaneous acute intestinal obstruction. *Lancet*, 2: 1089–1090, 1933.
10. Banks, A. G. and Green, R. D. Cancer of the cecum associated with acute appendicitis. *Brit. M. J.*, 1: 926, 1935.
11. Shears, G. F. *Clinique*, 27: 719, 1906.
12. Cook, J. Cancer of the cecum with acute appendicitis. *Brit. M. J.*, 2: 1083, 1936.
13. Seegers, W. Cancer of cecum resembling appendicitis. *Zentralbl. f. Chir.*, 65: 744–48, 1938.
14. Speese, J. and Bothe, F. A. Tumors of cecum simulating acute appendicitis. *S. Clin. North America*, 8: 917–21, 1938.
15. Bartlett, M. K. and Miller, R. H. Cancer of the cecum—acute appendicitis as a complication. *New England J. Med.*, 222: 783–784, 1940.
16. Young, E. L. and Wyman, S. Primary carcinoma of the appendix associated with acute appendicitis. Report of a case. *New England J. Med.*, 227: 703–705, 1942.
17. Uihlein, A. and McDonald, J. R. Primary carcinoma of the appendix resembling carcinoma of the colon. *Surg., Gynec. & Obst.*, 76: 711–714, 1943.
18. Chomet, B. Carcinoma of appendix. *Am. J. Clin. Path.*, 14: 447–451, 1944.

EMBRYONAL TUMORS OF KIDNEY IN INFANCY AND CHILDHOOD

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RENAL tumors were known to surgeons for a long time. Koenig attempted to classify them as early as 1826. Rathery, in 1870, called attention to the fact that the kidney was the organ most frequently affected by malignant disease in infancy. Jacobi, in 1884, demonstrated the frequency of these tumors and studied their typical structure and demonstrated their presence at birth. Ewing[1] states that it is rare after the tenth year and is usually found in the first three years. It has been found to be responsible for the largest percentage of malignancy in infancy and its large size has been reported as a cause of dystocia. A more complete review of the history of renal tumors may be had by reference to articles by Kretschmer[2] and Gilbert.[3]

Kidney tumors may be divided according to their histological structure and according to the character of the growth of the tumors into three groups: (1) *Benign:* lipoma, chondroma, osteoma, fibro-adenoma; (2) *malignant:* sarcoma, adenosarcoma, adenomyosarcoma, teratoma and sarcocarcinoma, and (3) *cysts:* congenital cystic kidney, hydronephrosis, pyonephrosis and ecchinoccal cysts of kidney.

Many attempts have been made to give a satisfactory explanation of these curious tumors. Some do not explain all the features and some contradict each other. Wilms[15] supposed that undifferentiated germs of mesoderm were deposited in the primitive kidney at a very early period of embryonal life where they acted as a matrix for composite tumors composed of various tissue elements. Dean and Pack[4] have given an excellent review of the various theories. They concluded that (1) the tumor originates at different developmental periods of the embryo; (2) the renal blastoma or nephrotome is a predominating contributing structure, and a tumor anlage which establishes itself at this stage will elaborate tissue easily recognized as renal in origin; (3) in a tumor anlage which separates earlier, before the formation of the nephrotome, there is a larger number of possibilities for elaborating multiple tumor cells, which may account for the presence of muscle fibers and other tissues in the tumor.

Pathology. The tumors vary greatly in size. They have been reported to be as large as 5,000 Gm.; one case was reported in which the distended abdomen extended down to the knees. The tumors are predominantly unilateral (85 to 90 per cent), encapsulated, retroperitoneal and arise within the kidney capsule. The kidney takes no part in the tumor formation and usually there is a layer of fibrous tissue between the neoplasm and the atrophied kidney which is reduced to a shell. The tumors are usually of a hard elastic consistency, smooth, irregular and non-fluctuating. There may be areas of necrosis in different parts (usually at the areas of most rapid growth). Due to various tissue elements present, the cut surface will reveal areas where different cells are in preponderance. The blood supply is usually extremely rich and it is not uncommon to see many blood sinuses throughout the tumor.

Histologically, the most striking feature is the embryonal character of the cells. The tumor is in true sense a mixed tumor, the usual cells found being composed of epithelial, fibroblastic and smooth muscle cells. Other cells that have been reported are striated muscle, cartilage and bone. A

great many varieties of arrangement of the above elements have been reported. The cells are usually of cuboidal or cylindrical character arranged about a lumen, so as to resemble an abortive renal tubule. Between these are usually seen strands or sheets of fibroblastic cells among which may be found groups of smooth muscle cells, striated muscle, cartilage and in rare cases, bone.[1]

Clinical Symptoms and Findings. The outstanding feature is the presence of an extremely rapidly growing mass and in the majority of cases this is the only thing noticed until late in the disease when loss of weight, digestive disturbances and pain make their appearance. The mass is usually hard, smooth, non-fluctuating and freely movable. The enlargement is the first symptom in about 85 per cent of cases; while in adults the enlargement is the first symptom in only 23 per cent of cases. Pain is very rare in children (about 7 to 8 per cent) while in adults it often is the first symptom. Pain, when found, is usually in the back and loins.

Hematuria, casts and albumin are usually the last findings, when they do occur, for in over 50 per cent of the reported cases, repeated urine examinations were negative to the end. This is also a differentiating factor between tumors of children and adults, for in adults it is practically a constant finding.

The general well being of the patient is usually very slightly or not at all affected in the beginning. It is not until the end of the illness that there is a rapid loss of weight; red cells and hemoglobin rapidly go down and cachexia ensues. At this time digestive disturbances set in, varying from nausea to severe vomiting with no retention of any food. There usually is constipation to obstipation, but it is not uncommon to see severe diarrheas with extremely foul greenish stools.

Diagnosis. These tumors are not diagnosed any earlier or more frequently today than they were forty years ago. General clinical examination, the history, and physical examination lead to their recognition. There are no early symptoms. The classical triad of hemorrhage, pain and tumor is of no value in children, for as previously pointed out, the cardinal feature is only the rapidly growing mass. In the differential diagnosis the following are to be considered.

An enlarged spleen may be recognized by its general form, the more anterior position, the greater mobility, its displacement by respiration; probable alteration of the blood picture may facilitate diagnosis.

A liver tumor can often be differentiated by its relationship to the lower border of the lung, possible jaundice and functional tests.

In acute cases of hydro- and pyonephrosis the sudden onset with collapse, high fever, etc., through torsion will help us, while in the slower cases of compression or stricture, a round fluctuating mass is found.

Cystic kidney is as a rule bilateral with lobulated surface. Large tumors of this type are not seen for they cause death.

Ecchinoccic cysts are diagnosed easily if perforation of the urinary tract takes place and hooklets or daughter cysts are found. Eosinophilia is of value if over 7 per cent and intestinal parasites can be excluded.

Adrenal tumors (neuroblastomas) are only recognizable as such if they give the typical metastases in the liver (Pepper type) or in the skull with orbital hemorrhages (Hutchinson type).

Enlarged mesenteric glands are generally found in the median line; malignant tumors are smaller, harder and more nodular.

Tubercular growths are seen more in the lower abdomen and usually lie transversely.

Peritoneal cysts are fluctuating, more movable and not so large in size.

Ovarian cysts as a rule can always have their connection with the uterus ascertained and patients are sometimes subject to precocious menstruation.

Psoas abscesses are most easily palpable above the inguinal ligament and have an oblong shape. They cause a typical position

of the leg and extension of the thigh is painful.

Considering all of the above, a diagnosis is still impossible many times without an exploratory laparotomy. The laparotomy is advisable for no matter how difficult the diagnosis may be, the treatment is most certainly even more so.

Prognosis. Prognosis is indeed very poor with figures by McNeill and Chilko[5] well over 90 per cent in a series of 383 cases. In smaller series of cases it was 100 per cent as in Bothe's series of seven cases.[6]

Treatment. Because of the varied structure of the tumor, depending upon the developmental period of the embryo when it took origin, the rate of growth and response to various kinds of treatment, treatment is greatly variant. The time in the disease that consultation is sought and the patient's condition also play a great part. The rapidity with which metastases have been seen to occur in patients under observation is another deciding factor.[7] There have been, as a result, various methods of treatment instituted by different men. Ladd and White,[8] in reviewing sixty cases, stress immediate surgery as soon as the diagnosis is made. They advise immediate surgery because during the time that is required for preoperative radiation and the waiting period for surgery, the chance for metastasis by way of the blood stream is very good. They are of the opinion that if the patient is adequately prepared physiologically, the operative mortality is negligible; that the tumor should be approached by the transperitoneal route so that the renal vessels may be ligated first, thus preventing dissemination of viable tumor cells. They also are of the opinion that preoperative radiation for shrinkage of the tumor may force malignant cells into the blood stream. Of the sixty so managed, fourteen were probably cured and in four the operations were too recent to form any conclusions.

Dean[7] employed radiation alone in twenty cases in the past fifteen years and reports that five of the patients are living without any evidence of metastases five or more years after treatment. Although this is a high percentage of cures, he does not recommend this procedure because even in the most radio-sensitive cases it probably requires many months to devitalize the tumor completely, and during this time metastasis can take place. He reserves exclusive radiation for those cases that present metastatic lesions already present, believing that at that stage surgery has nothing to offer.

Randal[9] stresses the advantages of preoperative irradiation over postoperative irradiation, pointing out that recurrences after irradiation exhibit increased resistance to this form of therapy and ultimately the new growth exceeds irradiative destruction, i.e., becomes "fast" to any type of irradiation. He also considered the importance that preoperative irradiation include the chest and abdomen in order to attempt creation of an unfertile field for metastatic transplants that may be dislodged by the handling of the tumor at extirpation.

Kerr and Stephens[10] also stressed the use of irradiation preoperatively as being of great value, concluding that it appears that on those operable cases, preoperative roentgen therapy improves the prognosis while postoperative therapy apparently has nothing more to offer than surgical removal without irradiation.

Priestley and Broders,[11] in their review of sixty-five cases of Wilm's tumor, conclude that preoperative irradiation followed in three to six weeks by nephrectomy with extensive postoperative irradiation was the treatment of choice.

Soloway,[12] Bixler, Stenstrom and Creevy[13] and Rowe and Frazer[14] are also of the opinion that pre- and postoperative irradiation should be used and constitute the methods of choice.

The various methods of treatment for Wilm's tumor may be summarized as: (1) surgery alone, (2) radiation therapy alone, (3) surgery with preoperative radiation, (4) surgery with postoperative radiation,

and (5) surgery with preoperative and postoperative radiation. The results of treatment by various methods in thirteen different series of cases is given by Bixler, Stenstrom and Creevy.[13] The final answer will come with further study in the publications of the future. Results, as a whole, are poor regardless of the method of therapy instituted.

CASE REPORT

J. M., a male infant, seven and a half months of age, was admitted to the Norwegian Hospital with a complaint of a rapidly growing abdominal mass. The mother first noticed a rather large, hard mass in the right upper quadrant about three weeks prior to admission. She stated that at first the mass seemed tender, but after a few days the baby did not mind pressure over the mass. Except for being slightly restless at night, the mother claimed the baby had not appeared to be sick, though she thought it might have had a little fever at night. The baby had been breast fed until one week prior to admission, when he was put on a formula. Stools were normal, but after being given the formula they became loose and very soft. At times the mother had noticed curds and mucus in stool, but no blood. The baby was full term at delivery. Delivery was by low forceps but otherwise uneventful. The baby progressed very well, taking breast as mentioned and ate cereals, vegetables, eggs, applesauce and other baby foods which were all well tolerated. He had taken cod liver oil and orange juice daily. The family history revealed nothing of a contributory nature. Physical examination revealed a well nourished, well developed male infant about seven and a half months old, resting comfortably in bed, with no evidence of any distress; hemic component was good, respirations normal, there was no dehydration, eruptions or evidence of any acute illness. Detailed physical examination revealed nothing of note except the abdomen, which was of irregular contour with an enlargement in right upper quadrant. The skin was tense and there were a few prominent veins visible over the enlargement. The mass extended out to the flank and back and downward to the umbilicus. It was hard, smooth and globular in shape. The mass was distinct from the liver and was freely movable. Percussion note over the mass was flat. No fluid wave was elicited. The mass was apparently the kidney. The left kidney was not palpable, nor was the spleen.

Urine examination on admission revealed it to be straw-colored, clear, with an acid reaction, specific gravity 1020, with a trace of albumin, few uric acid crystals with no white or red blood cells. Blood count on admission: red blood count, 4,300,000; hemoglobin 85 per cent; white blood count 12,700, neutrophils 73 per cent, lymphocytes 25 per cent, endothelial 2 per cent. Stool examination on admission showed a slight amount of mucus but no blood or parasites. *X*-ray examination revealed a large opaque mass occupying the entire right upper quadrant of the abdomen. Skull, lungs, spine and long bones revealed no evidence of metastases.

Diagnosis of neoplasm of right kidney, probably Wilm's tumor, was made and nephrectomy was performed by the transperitoneal route. No special difficulties were encountered and infant withstood the operation very well. The mass was retroperitoneal and about five to six inches in diameter, more or less globular in shape. It displaced the liver upward and the transverse and ascending colons toward the midline. The kidney itself was thinned out and reduced to a mere shell. Microscopic section showed two types of tissues, fibrous and epithelial. The fibrous tissue was dense and stained very deeply. Section showed spaces lined with what appeared to be papillae undergoing fibrous replacement. The epithelial cells were cylindrical in type and arranged in a heterogenous glandular arrangement, surrounded by loosely woven, but very cellular connective tissue. There were several areas of necrosis and hemorrhage in the epithelial portion. Pathologic diagnosis was: Embryoma of right kidney.

The infant made an uneventful recovery and was discharged from the hospital exactly two weeks following operation. The infant progressed very well, gaining weight, etc. Two weeks later, infant began to receive irradiation with the thought in mind of preventing metastasis. However, one month following discharge from hospital a small mass in the left kidney area made itself apparent to deep palpation. This mass grew very rapidly in the face of continued roentgen therapy and inside of one month had reached to almost the size of the original tumor on the right side. The baby's

condition during this month became steadily worse in spite of adequate supportive measures and finally, by the end of the month, the infant expired. Postmortem examination was refused by the family, but there is no doubt that the growth in the left kidney was of a metastatic nature and definitely associated with the original tumor.

SUMMARY AND CONCLUSIONS

1. Tumors occur within the first three years of life.

2. They are definitely embryonal in nature.

3. Development is independent of the kidney. The kidney itself does not take part in the growth, but undergoes atrophy and is reduced to a shell.

4. Growth is extremely rapid, producing tumors of enormous size, and they are usually unilateral.

5. Associated symptoms are few and occur late.

6. Various methods of treatment and management are stressed.

7. A case report is presented.

REFERENCES

1. Ewing, J. Neoplastic Disease. 4th ed. Philadelphia, 1940. W. B. Saunders Co.
2. Kretschmer, H. L. *J. Urol.*, 39: 250, 1938.
3. Gilbert, J. B. *J. Urol.*, 39: 223, 1938.
4. Dean, A. L., Jr. and Pack, G. T. *J. A. M. A.*, 98: 10, 1932.
5. McNeil, W. H., Jr and Chilko, A. J. *J. Urol.*, 39: 257, 1938.
6. Pack, G. T. and Livingston, E. M. Treatment of Cancer and Allied Diseases. New York, 1940. Paul B. Hoeber, Inc. (Chapters by Waters and Botke).
7. Dean, A. L. *New York State J. Med.*, 45: 1213, 1945.
8. Ladd, W. E. and White, R. R. *J. A. M. A.*, 117: 1858, 1941.
9. Randal, A. *Ann. Surg.*, 100: 462, 1934.
10. Kerr, H. D. and Stephens, R. L. *Am. J. Roentgenol.*, 50: 204, 1943.
11. Priestley, J. T. and Broders, A. C. *J. Urol.*, 33: 544, 1935.
12. Soloway, H. M. *J. Urol.*, 40: 477, 1938.
13. Bixler, L. C., Stenstrom, K. W. and Creevy, C. D. *Radiology*, 42: 329, 1944.
14. Rowe, E. W. and Frazer, M. D. *Radiology*, 42: 107, 1944.
15. Wilms, Max. Die Mischgeschwuelste der Niere, Leipzig, 1:1–90, 1899. Arthur Georgi.

A MODIFIED WHIPPLE OPERATION FOR CARCINOMA AT THE AMPULLA OF VATER*

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SINCE 1935, when Whipple, Parsons and Mullins advocated their technic for the radical removal of carcinoma of the ampulla of Vater and the head of the pancreas, numerous modifications have been proposed. The original operation was performed in two stages. In the first stage the common duct was ligated and a cholecystojejunostomy was performed. In the second stage the lesion was removed and a gastrojejunostomy performed. Whipple now completes the operation in one stage. Orr's modification consisted in performing an operation in two stages. In the first stage a choledochogastrostomy and a posterior gastrostomy were completed. In the second stage he removed the head of the pancreas with the duodenum. Horsley operated upon a patient for carcinoma of the ampulla of Vater, which histologically proved to be a benign growth. After the removal of this lesion with the duodenum and head of the pancreas he implanted the common duct into the open end of the duodenum. The pancreas was also included in this anastomosis. In another case in which the gallbladder had been removed, Hunt performed a choledochojejunostomy. The pancreas was implanted into the distal portion of the jejunum. Brunschwig performed the operation in two stages. In the first stage a cholecystojejunostomy and a posterior gastrojejunostomy were performed. In the second stage the diseased area was excised. The free end of the pancreas was oversewn. Hunt and Trimble then advocated a one-stage operation with the common duct anastomosed to the jejunum with the aid of a T tube. The pancreas was inserted into the proximal end of the jejunum. In the operation as advocated by Trimble in one stage the same technic is used, except that the cut end of the pancreas is oversewn.

CASE REPORT

J. S., age forty-three, a female, was admitted to the Mt. Sinai Hospital on December 14, 1944, service of Dr. Abraham Trasoff, and she was discharged on February 3, 1945. Her chief complaint was jaundice for one year, bile stained urine and light stools. There was no weakness, nausea, vomiting or fever. At the outset of her symptoms the abdomen was enlarged due to gaseous distention. Eructations of gas were frequent. Pruritis was an annoying symptom. She lost ten or twelve pounds in weight. Her previous history and family history were unimportant.

A physical examination revealed a patient with generalized jaundice with slight rigidity in right upper quadrant of the abdomen. The icteric index at this time was 65. In the following few weeks after March 7, 1944, the jaundice decreased somewhat and the pruritis abated. Then for the following five months the jaundice and pruritis became more severe. She refused hospitalization at this time because she never had any abdominal pain. She came to the medical clinic on December 7, 1944, and was admitted to the hospital on December 14th. Blood pressure was 110/64. There was no edema or cyanosis. The sclera were stained a deep yellow. The tongue was very dry and there were small palpable lymphatic glands in the submaxillary areas. The heart was normal. There were no murmurs and the heart was not enlarged. There was no diminution of the breath sounds. Some impairment to percussion in both upper portions of the chest posteriorly was noted. The remainder of the chest was

* From the Service of Mt. Sinai Hospital, Philadelphia, Pa. Read before the South-Southeast Branches of The Philadelphia County Medical Society on March 20, 1945.

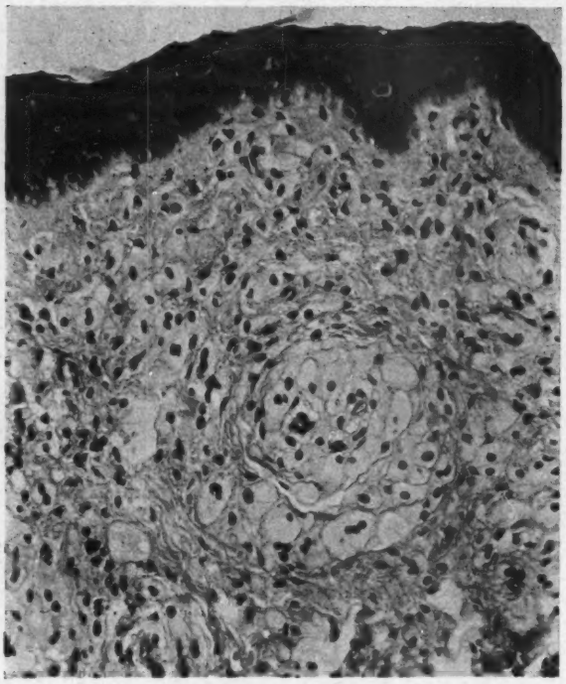

FIG. 1. Section of skin showing xanthomatous cells.

normal. No râles were present. The abdomen was soft without splenic enlargement. The area over the gallbladder was rigid. The liver was somewhat enlarged and could be felt below the umbilicus. The edge was irregular. The surface seemed smooth and not tender. The diagnosis at this time was carcinoma of the head of the pancreas with possible metastasis to the liver.

Laboratory findings were as follows: Urine reaction acid specific gravity 1005; protein ft., sugar negative; white blood cells 30–35; red blood cells occasionally; urobilinogen in urine 1.60 dilution; hemoglobin Gm. 8.7 per cent (62 per cent); red blood count 3,030,000; white blood count 10,700; seg. 67; non-seg. 6; lymphocytes 17; monocytes (trans.)—4; eosinophiles—6. platelets—220,000; fragility—0.48—0.30; prothrombin time 15 per cent; blood sugar 117. BUN 10.1; cholesterol 624—cholesterol esters 290—ratio 46 per cent. phosphorus—3.4; phosphatase—12.4 units; van den Bergh 4.8 mg. per cent; icteric index—124; hippuric acid test 2.2 Gm.; total proteins—6.4; benzoic acid—3.4 Gm. in four hours; ceph. flocc.—0. W. and K.—negative; serum amylase—205; U/100 cc. of serum.

On December 20th, I was called in consultation to give a surgical opinion. Physical examination revealed the liver to be very much enlarged. The gallbladder was also enlarged giving rise to Courvoisier's sign. The spleen could not be palpated. The patient was jaundiced due to obstruction of the common duct as a result of carcinoma of the head of the pancreas.

On December 29th, a piece of skin was removed and sent to the laboratory for histological examination. Dr. D. Meranze, Director, reported that the specimen consisted of a piece of skin measuring 2.5 by 0.3 cm. The cut surface presented no unusual features. Under the microscope small aggregates of non-specific xanthomatous cells were present. The pathological diagnosis: skin xanthomatosis. (Fig. 1.) Six months after operation all evidence of skin xanthomatosis had disappeared. One year after operation revealed a normal condition of the skin body surface.

The findings at operation revealed a papillary carcinoma of the papilla of Vater (Fig. 2.), marked dilatation of the biliary system, hydrops of the gallbladder, biliary cirrhotic liver and marked enlargement of the liver.

On January 5, 1945, under fractional spinal anesthesia, the abdomen was prepared in the usual manner, and an upper right rectus incision was made through the peritoneum. All bleeding points were caught, clamped and ligated with plain No. 0 catgut. The gallbladder was found to be enormously enlarged, measuring approximately 8 by 5 cm. The common bile duct was seen to be enormously dilated, measuring approximately 1.3 cm. in diameter. The common bile duct was palpated. No stone or induration could be felt. The head of the pancreas was then palpated and found to be of normal consistency. At the entrance of the common bile duct into the duodenum a papillary neoplasm was felt protruding into the duodenum. Although the gallbladder was very tense, upon pressure it was partially emptied into the duodenum. The tension of the gallbladder was then released by means of a trochar and cannula. The common duct was incised longitudinally. A lead probe was passed into the common duct and passed readily into the duodenum meeting only a slight obstruction at the papilla of Vater. The duodenum was mobilized by blunt and sharp dissection. Stone clamps were placed at the duodenal cap, and the duodenum was incised between the clamps. The pyloric stump was inverted by three layers of sutures. The duodenum was then freed and doubly clamped at the junction of the second and third portion of the duodenum and cut between clamps. The distal stump was inverted

Fig. 2. Papillomatous tumor acting as a ball valve at the ampulla of Vater.

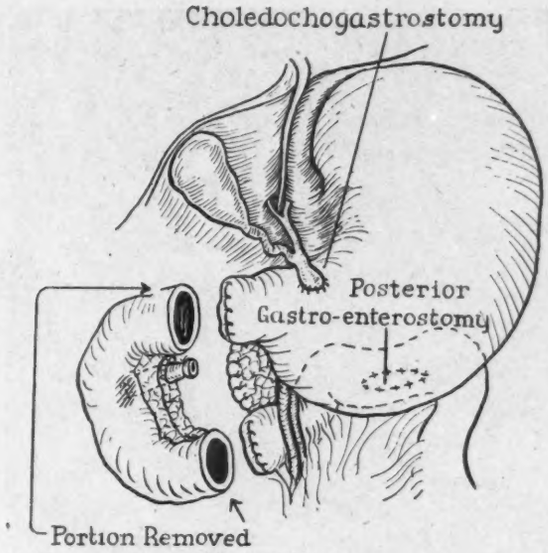

Fig. 3. A modified Whipple operation illustrating anastomosis of the common duct to the stomach.

by three layers of sutures and the common bile duct was cut across approximately 3 cm. from the ampulla of Vater. A wedge-shaped portion of the pancreas was excised along with the duodenum and the distal portion of the common duct. The head of the pancreas was oversown with interrupted linen sutures, and a pad of fat was brought down to cover the inverted stump. The common duct was then anastomosed to the prepyloric end of the stomach with a water-tight suture line. The transverse mesocolon was incised, the proximal portion of the jejunum was brought through this opening and a side-to-side anastomosis was performed between the stomach and jejunum. The jejunum was then sutured to the edges of the incision in the mesocolon with interrupted sutures. (Fig. 3.) A Mikulicz drain was placed to the pancreatic bed. The peritoneum was closed with two rows of continuous No. 2 chromic catgut. The fascia was approximated, and the skin was closed with silk sutures.

The one-stage operation, whenever it can be done, is far superior to the two-stage operation. The complications arising from adhesions in a two-stage operation are avoided in a one-stage procedure.

Operative findings and procedure were choledochogastrostomy, excision of the first and second parts of the duodenum, excision of the head of the pancreas, gastrorrhaphy, jejunorrhaphy and posterior gastrojejunostomy.

Clinical data and diagnosis reported carcinoma of the ampulla of Vater, marked dilatation of common bile duct and gallbladder and marked hepatomegaly. Macroscopically, the first specimen was a portion of duodenum including the papilla of Vater. It measured 9 cm. in length and 7 cm. in circumference. A small portion of pancreatic tissue was attached to the duodenum. Surrounding the ampulla of Vater there was a raised, ulcerated papilla measuring 2.8 by 1.2 cm. Its center was depressed and ulcerated. Two cm. of common bile duct were present. The latter measured 2 cm. in circumference. Its wall was thickened and its mucosa slightly roughened and mottled with yellow specks. Similarly, 2 cm. of pancreatic duct was present, measuring 1.4 cm. in circumference. Its wall was thickened and its mucosa congested. The neoplastic process at the papilla caused partial obstruction. On section the wall beneath the papilla was thickened, grey and infiltrated. The wall measured 1.2 cm. in thickness. The uninvolved duodenal mucosa appeared relatively normal. The attached pancreatic tissue measured 2 by 1.5 cm. and was slightly infiltrated with fatty tissue. There were several small, congested, greyish lymph nodes present on the serosal surface at the level of the papilla. The second specimen was a portion of common duct measuring 2 cm. in length by 1.2 cm. in diameter, with a

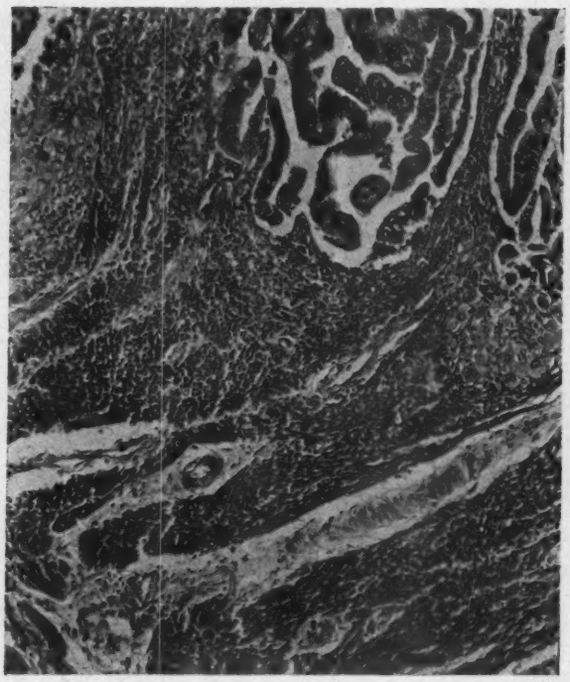

FIG. 4. Section of duodenal wall showing adenocarcinoma invading the muscle layer.

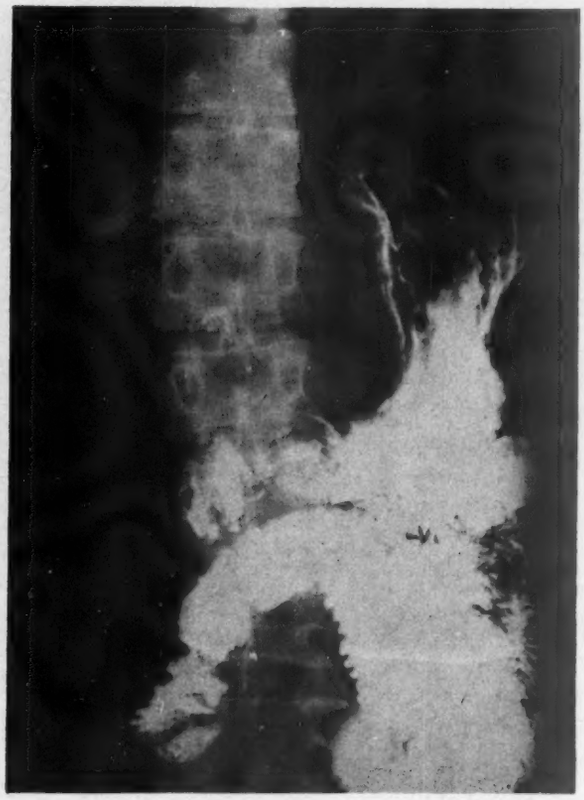

FIG. 5. *X*-ray taken one year after the operation, illustrating the evacuation of barium through the gastro-enterostomy.

portion of pancreas attached, measuring 1.5 by 1 cm. The wall of the common duct was slightly thickened. Its mucosa appeared relatively normal. The attached pancreas resembled the pancreatic tissue described above.

Microscopically, a primary, ulcerating adenocarcinoma had penetrated as deeply as the outer muscle layer. (Fig. 4.) It was also seen in the serosal fat in the neighborhood of lymphoid tissue. The small lymph nodes sectioned showed no metastic involvement. The pancreatic tissue showed extensive fibrosis.

Pathological Diagnosis: The duodenum reveals a primary ulcerative carcinoma of the ampulla of Vater with extension into the regional fat and lymphoid tissue. The pancreas showed a chronic fibrosing pancreatitis. The common bile duct was normal.

Comment. Jaundice was present in this patient for one year. One should be reminded of the fact that jaundice which has persisted for twelve months should have had some surgical remedial measure performed long before this case was assigned to the surgeon. The history states in full the characteristics in this case, but the main physical sign was that of Courvoisier's sign which is usually confirmatory of some malignant condition at the ampulla of Vater or the head of the pancreas. As a result of the character of the growth which was a papillary carcinoma at the ampulla of Vater, the jaundice would occasionally disappear. It acted, in other words, like a ball valve stone. A successful one-stage, modified Whipple operation was performed. The essential step in this modification was the performance of a choledochogastrostomy. The convalescence from this operation was excellent. As a matter of fact, ten days after operation the patient could have left the hospital. The presence of bile in the stomach as a result of this type of anastomosis caused little or no disturbance. She did not vomit bile or any other stomach contents following the operation. There was practically no drainage from the wound following the introduction of a Mikulicz drain for leakage that might have occurred. A small amount of serous fluid exuded.

Follow-up of Patient. In August, 1945, there was no jaundice. The patient had not

gained any weight but she felt perfectly well.

In November, 1945, her complexion was clear but there was no gain in weight. She stated that there were lumps along the line of the abdominal incision. These nodules were subjected to radiation. Following operation for gastrointestinal carcinoma nodules are frequently seen occurring around the healed abdominal wound. These secondary tumors are usually radiosensitive. In only one case was it necessary to remove the metastases after the use of *x*-ray.

In January, 1946, the patient was readmitted to Mt. Sinai Hospital. The skin was perfectly normal in color; there was no jaundice of the sclera; the metastatic growth in the wound was much smaller than on the previous examination due to the *x*-ray treatment. There was some evidence of weight loss, but the patient was cheerful and happy. The bowel movements were not acholic.

On January 22, 1946, the *x*-ray examination revealed the following: the esophagus and stomach were normal in size, shape and position. The stomach was fixed and tender on palpation. Gastric peristalsis was sluggish but evacuation was rapid through the gastro-enterostomy. There were no evidences of gastric or pyloric lesions.

The duodenum showed filling of the first portion only and this appeared slightly deformed. There was a fine fistulous tract just above the pylorus in the region of the pancreas filled with barium.

On January 7, 1946, the nodule in the abdominal wound was excised. Microscopic examination revealed a secondary adenocarcinoma of the rectus muscle.

The patient was discharged January 17, 1946, and was in the usual optomistic frame of mind. Slight jaundice was present and a noticeable loss of weight was observed.

Comment. The patient lived in comparative comfort for one year following the operation. She was free of pain and jaundice up to her recent admission a few weeks ago. She had had no digestive disturbance. There was no steatorrhea or any change in the bowel movements. On her last admission (January, 1946), a physical examination of the abdomen revealed definite hardness and some rigidity in the epigastric region. This was due no doubt to the metastic growth in the abdominal wall and also to an enlarged liver. She did not complain of pain or other discomfort in this area. Her skin on admission was clear, but after the removal of the nodule in the abdominal wall for microscopical examination she became jaundiced again. After a few days this jaundice faded considerably. It is interesting to note the changes in laboratory examinations of a year ago as compared to those taken upon her last admission.

REFERENCES

WHIPPLE, A. O. Pancreaticodcodenectomy for islet carcinoma. *Ann. Surg.*, 121: 847, 1945.

BRUNSCHWIG, ALEXANDER. The Surgery of Pancreatic Tumors. St. Louis, 1942. C. V. Mosby Company.

CONGENITAL HERNIA IN A MALE CONTAINING A RUDIMENTARY UTERUS

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MUCH has been written about hermaphroditism as to embryologic, anatomic and hormonal aspects, but these cases are of little clinical importance other than as medical curiosities. It is the purpose of this paper to discuss the clinical aspect of tubular pseudohermaphroditism in males and its relation to congenital hernia and cryptorchidism. A tubular pseudohermaphrodite is a person having the glands of one sex and at the same time bearing the tabular accessory structures of both sexes. A case is reported, but of greater significance, the attention of physicians and especially of surgeons is called to the possibilities of such cases. The syndrome of "Hernia Uteri Inguinalis In Men," as first used by Nilson, is characterized by congenital hernia containing a uterus and associated very often with contralateral cryptorchidism.

It is well known that early in fetal life every person is potentially bisexual. The gonad, arising from the genital ridge, potentially contains the primordial structures of both ovary and testis. In the normal male the testicular tissue dominates, under chromosomal and hormonal influence, reducing the potential ovarian tissue to vestiges. Likewise, two sets of tubular structures appear, the Wolffian and Müllerian ducts. In the male, the vas deferens, the seminal vesicle, and the epididymus are formed from the Wolffian duct. The Müllerian duct normally atrophies leaving only vestigial remains, namely, the canals of Rathke, the non-pedunculated hydatid, and the prostatic utricle. The non-pedunculated hydatid, when present, is found on the testicle and represents the cephalic end of the Müllerian duct; the prostatic utricle near the center of the posterior surface of the prostate gland represents the caudal end.

It is probable that completeness in reciprocal degeneration and growth is rarely produced and that varying degrees of low grade intersexuality occur normally, as evidenced by rests of primary gonadal tissue in ovaries and vestiges of the two paired ducts in both sexes.

Between the extremes of a few cases of true hermaphroditism as evidenced by microscopic finding of an ovotestis, and the overwhelming number of normal males with only vestiges such as the canals of Rathke, the non-pedunculated hydatid, and the prostatic utricle as rudiments, are a number of cases of tubular pseudohermaphroditism with which we are particularly concerned.

CASE REPORT

R. M., a thirty-eight-year old white male, was admitted to the Sewickley Valley Hospital on October 1, 1944. His complaint was of a right inguinal hernia which had developed gradually at the age of sixteen but since that time had not increased in size. A support has been worn for the past twenty years with great success. The only symptom was slight pain during the development of the hernia, but during the past twenty years he has been entirely symptom free except for an occasional twinge of pain felt in the inguinal region when the mass slips into the scrotal sac. He presented himself for surgery only at the insistence of his employers.

His past history revealed scarlet fever at twenty-one and pneumonia at the age of eighteen. There was no history of venereal disease. He was married at twenty-eight, leading a normal and happy marital life, except for

Fig. 1. Photograph illustrating normal genitalia, and normal male secondary sex characteristics.

the unrealized wish for children. In 1940, he sought medical help in an effort to remedy this. Unfortunately, complete sterility investigation was not undertaken. However, examination of his wife was entirely negative. A specimen of sperm removed from the seminal pool showed poor motility and an increased number of atypical forms. The patient had noticed a diminishing libido in the past few years.

Physical examination revealed a well developed, robust white male in good general condition weighing 182 pounds and being 5 feet 10 inches tall. His beard was full but soft and he was pink cheeked. His blood pressure was 190 systolic with an average diastolic reading of 90 mm. of mercury. The A:V ratio of retinal vessels was 2:5. Moderate tortuosity and moderate blurring of the A:V crossings was present. Detailed examination was otherwise negative except for the presence of a relaxed right external inguinal ring which easily admitted two fingers. A cough impulse was present on this side. Both testes were of normal size and consistency. The penis and prostate gland were unaltered.

Usual laboratory tests were all within normal limits. Both Kolmer and Kahn tests were negative.

At operation a mass about 2 cm. in diameter and 6 cm. in length, was found in the right inguinal canal. A sac was not demonstrable. The surgeon was puzzled but believed that the mass was a group of varicose veins which had undergone inflammatory changes brought about by the truss which the patient had worn for a great many years. The vas deferens was so incorporated in the mass that a portion of it was removed. On the left side a small indirect hernia was found, the sac was ligated, and the repair completed.

Macroscopically, the specimen was a tough, shaggy, irregular mass of formalin fixed tissue which measured 63 by 25 by 25 mm. Multiple sections revealed the mass to be composed of a hollow tube with a smooth mucosal-like lining and a smooth muscle wall. Adherent to one side were many dilated tortuous veins and a portion of the vas deferens.

Microscopic examination of sections through the mass revealed it to be composed of a smooth muscle wall with many bundles running in interlacing courses, resembling the wall of a uterus. The lumen was lined by columnar epithelium and beneath this lining there were many regular gland-like structures resembling those seen in the endometrium. There was no true endometrial stroma but some small cells near the surface resembled stromal cells. The pathologist's diagnosis was rudimentary uterus found in an inguinal canal. Nothing resembling ovarian tissue was found.

Eight months postoperatively, the repairs were intact and the patient was in good health. However, shortly after the operation he lost 12 pounds which he had been unable to regain. He also volunteered information concerning his beard, which he believed is definitely more coarse and more difficult to shave. For four months libido was further decreased but since then has increased. He is now more hopeful than ever before of having a child. A sperm count nine months postoperatively revealed a marked reduction not only in motile spermatocytes but an overall total reduction. Atypical forms constitute 35 per cent of the sperm present.

Fig. 2. Microphotograph of rudimentary uterus removed from right inguinal canal of a male. × 10.

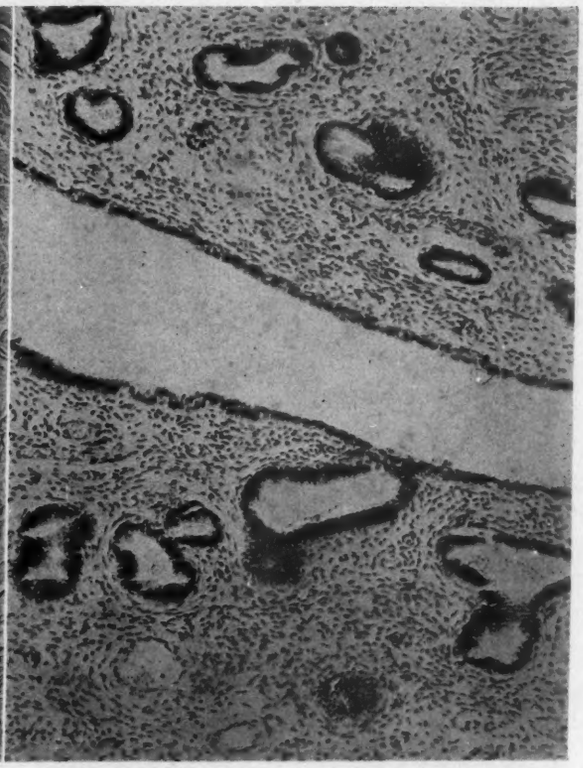

Fig. 3. High power microphotograph of rudimentary uterus removed from right inguinal canal of a male. × 120.

Briefly summarizing the thirty-six existing reported cases reveals certain common and important findings: (1) Sixty per cent of the hernias were scrotal. (2) In 86 per cent of the cases there was cryptorchidism. In twenty-one of the cases (70 per cent) the cryptorchidism was contralateral; in four cases (13 per cent) the cryptorchidism was bilateral; in one case the cryptorchidism was on the side of the hernia. (3) The size of the uterus was variable but most often normal. In three cases the organs consisted of undifferentiated Müllerian duct; in three cases a well differentiated bicornuate uterus was present; in five cases the uterus was rudimentary; in four cases the uterus was oversized; in eight cases no statement was made. (4) In no case was there any ovarian tissue discovered. (5) In only a few cases were the marriages productive of offspring.

The maldevelopment or more accurately a lack of reciprocal degeneration may be due to hormonal influence. Just where this hormonal influence arises is difficult to say for complete histological studies and hormonal assays were not done. It is not impossible that rests of ovarian tissue may be present and that these secrete sufficient hormones to prevent reciprocal degeneration. By puberty, when the male characteristics make themselves most prominent, these rests may have degenerated. The cause of the accompanying hernia and cryptorchidism is almost entirely mechanical. When the gubernaculum draws down the testis to which the persistent Müllerian duct is attached by its cephalic end, the latter accompanies it and further enlarges the internal inguinal ring. The increased mass seems to prevent the obliteration of the processus vaginalis. Whether or not this increased mass or the presence of inelastic and muscular uterus is the cause, it is a fact that migration of the uterus with one testis is often accompanied by contralateral cryptorchidism unless the uterus is infantile or rudimentary.

Thus though there may be many variations, the majority of cases follow so

similar a pattern as to constitute a syndrome. These cases are seen in apparently normal males at any age but usually early in life and are characterized by an indirect inguinal hernia, often scrotal, the contents of which are firm and unyielding. There is almost always cryptorchidism, most often contralateral. While the secondary sex characteristics are normal, the individuals are not strongly masculine, the beard being soft and libido decreased. The marriages of these men are usually barren. The patient presents himself to the physician, if at all, for treatment of the hernia and more rarely for the cryptorchidism. The size of the hernial mass varies with the state of development of the uterus but often is in a great part due to other organs present in the sac such as intestine or omentum.

Diagnosis was not made preoperatively in any of the cases; often not even at the time of operation, usually because of unawareness of such states. The diagnosis can be made preoperatively; at least it should be strongly suspected in a patient complaining of congenital hernia and contralateral cryptorchidism. Palpation of the uterus in the canal is very important but not entirely diagnostic because its firmness may be simulated by a mass of omentum, by a lipoma or a malignancy of the sac. It is important that the diagnosis be made at the time of operation for the treatment depends upon it. The ease with which these cases can be recognized will of course depend on the state of development of the uterus and adnexa.

The treatment is conservative. In most cases the uterus should be removed to affect a good and lasting repair. Care must be taken in the "hysterectomy" because the vas deferens lies in close apposition to it and might easily be damaged or destroyed. If the uterus is attached deep in the pelvis, the remaining stump must be thoroughly closed since it is continuous with the penile urethra.

In cases with cryptorchidism, the testicle should be placed in the scrotum. If this is impossible it should be removed, because of the danger of malignant degeneration if the testis is allowed to remain in the abdominal cavity.

REFERENCES

1. Braithwaite and Craig. Hernia of the uterus, vagina, and fallopian tubes in a boy. *Brit. M. J.*, 2: 176, 1914.
2. Brindeau. Uterus et trompes contenus dans une hernie inguinale chez un homme. *Arch. men. d'obst. et de gynec.*, 150, 1916.
3. Clark, E. D. Inguinal hernia attached to cord, undescended testicle, uterus, tubes, and broad ligaments. *Am. J. Obst.*, 71: 273, 1917.
4. Duse. Utero mascolino erniata con distopia transversa del testicolo sinistro. *Clin. chir.*, 18: 1497, 1910.
5. Fantino. Considerazioni cliniche su 4580 cherezioni perenia. *Chin. chir.*, 20: 1055, 1912.
6. Ferri, G. Case of strangulated hernia of uterus in hermaphrodite. *Osp. Maggiore*, 22: 341–354, 1934.
7. Hertzler, A. E. Ectopia testis transversa with infantile uterus. *Surg., Gynec. & Obst.*, 23: 597–601, 1916.
8. Heyl, J. H. Undifferentiated müllerian duct in man; unusual congenital anomaly as complication. *Arch. Surg.*, 29: 929–941, 1934.
9. Keith, A. Malformations of human body from new point of view; migration of testes. Hunterian Lectures-Brit. M. J.
10. Kimura, J. Transverse ectopy of the testes. *Ann. Surg.*, 68: 420–425, 1918.
11. Mackenzie, D. W. Pseudohermaphroditismus masculinus internus. Congenital malformation in scrotum—two testes and uterus in right portion of scrotum. *Surg., Gynec. & Obst.*, 34: 51–54, 1922.
12. Matas, R. Rare anomaly found in congenital right inguinal hernia; tubules diverticulum or prolongation of right seminal vesicle extending into scrotum as component of spermatic cord. *S. Clin. North America*, 2: 1155–1163, 1922.
13. Motiloff, L. Hernia of uterus in women and in persons of hermaphroditic development. *Ztschr. f. Geburtsch. u. Gynäk.*, 99: 330–336, 1931.
14. Nilson, Olaf. Hernia uteri inguinalis beim marine. *Acta. Chir. Scandinav.*, 83: 231–249, 1939.
15. Pellegrini. Utero colle due trombe e due testicol nrl sacco erniaris di un saggetta congenitali externi maschile normalmente conformati. *Ginecol.*, 10: 135, 1913.
16. Perroti, G. Hernia in young woman containing abnormal internal genitals. *Arch. di. oste e ginec.*, 15: 219–233, 1928.
17. Viscontini. Utero maschile e tromba di fallopian in ernia inguinale di un noma. *Gaz. dig. Osp. e delle Clin.*, 23: 234, 1912.
18. Von Seeman, H. Internal pseudohermaphroditism, cryptorchism, and congenital inguinal hernia in a man. *Ztschr. f. klin. Chir.*, 141: 370–379, 1927.
19. Webster, J. C. A rare case of hermaphroditism. *Surg., Gynec. & Obst.*, 3: 484–490, 1906.

TRAUMATIC RUPTURE OF A HYDROCELE SAC

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TRAUMATIC rupture of a hydrocele sac is a rather rare happening and it is to bring this occurrence to the eyes of the medical profession that the authors believe this case should be reported. Traumatic rupture of the hydrocele sac has been reported before; the last comprehensive report was that of Collins in 1930, who reported an analysis of sixty-one such cases.

The etiology of this happening is direct trauma to the hydrocele sac, which results in rupture of the tunica vaginalis.

The symptoms are acute and constant severe pain, sometimes with profound shock and swelling of the scrotum. The edema and discoloration may be sharply limited to the scrotum or may extend to the adjacent abdominal wall and the suprapubic region and the penis itself. If this condition is borne in mind, the diagnosis is usually not difficult to make.

The only adequate form of therapy for this condition is evacuation of the fluid and the accummulated hematoma, with the usual repair of the hydrocele sac.

CASE REPORT

T. M., (The Long Island College Hospital, No. 227485), a thirty-one-year old longshoreman, presented himself in the Emergency Room with a complaint of severe pain and marked swelling in the scrotum and penis.

He stated that he had had a tumefaction in the left scrotum for the past year and a half, which had neither grown larger nor smaller during this time, and was about the size of an orange. This had given him no pain until approximately forty-five minutes before admission to the Hospital when, while stepping on to a chair which slipped from under him and struck him in the scrotum, he experienced severe pain in the scrotum but no loss of consciousness. The patient was brought to the Hospital in an ambulance.

Physical examination on admission revealed a young, healthy adult male in acute distress and complaining of pain in the scrotum. The only abnormal findings were limited to the scrotum and adjacent areas. The left scrotum was ecchymotic as was the penis and the left inguinal region. The scrotal mass was painful to touch and very soft and fluctuant throughout and was soggy. The penis was markedly edematous and ecchymotic, being approximately three times the normal size. The corpora could be felt within this edematous area and the glans could be exposed by retraction of the foreskin and was normal in appearance. The patient voided spontaneously and the urine was negative, including microscopic examination. The patient was put to bed and treated with hot packs to the affected parts, and the next day the swelling in the penis had markedly reduced but the ecchymosis, swelling and tenderness in the scrotum were still present.

The patient was taken to the operating room where, with a two and one-half inch incision, the left testicle and investments were exposed. Much blood clot was evacuated and the tunica vaginalis was found to have a rent in the anterior wall which was about one and one-half inches in length. After the hematoma had been evacuated, the tunica vaginalis was stripped from its surrounding tissues and the redundant portion of the tunica vaginalis was trimmed off to approximately one-half inch of its visceral insertion. The cut edges were then sewn together behind the testicle. A Penrose drain was placed in the depths of the wound behind the

testicle which was replaced into the wound, and the wound was closed in layers.

The patient's postoperative course was entirely uneventful. He drained serosanguineous fluid for about seventy-two hours. The Penrose drain was removed in four days. The wound healed primum.

The patient was discharged on his ninth postoperative day and was instructed to wear a scrotal suspensory. He was followed in the Out-Patient Department for one and one-half months, at which time the wound was entirely and completely healed and the scrotum had returned to normal size.

REFERENCE

Collins, J. D. Traumatic rupture of the tunica vaginalis in hydrocele. *Southb. M. J.*, 23: 247, 1930.

Castration is indicated for malignant tumors, selected cases of torsion, advanced tuberculosis, certain severe injuries, undescended testis when too high in the abdomen to place in the scrotum, and as an elective procedure in certain very large hernias to permit some secure plastic repair.

From "Operations of General Surgery" by Thomas G. Orr (W. B. Saunders Company).

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GASTROSTOMY

ITS INCEPTION AND EVOLUTION

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DOWN through the years involved in the development of medical science, there has run a line of continuity sometimes not too easily discerned, but rather readily visible to one delving here and there into the medical literature of the past.

Some years ago considerable time and search was spent and an article published outlining only the highlights in the development of gastro-enterology as a subscience or branch of medicine. In gathering the material together for that article one could not help noting the orderly array or marshalling of facts leading up to new discoveries. Always at first, there were theories, finally proof. It seemed that as soon as a way or means of doing something or explaining something in procedure was discovered, and then finally proven, it was not the end by any means. A door closed as in a room but opened immediately into another, to other theories or ways possibly closely related, sometimes not, which then posed a new challenge and had to be worked out and proven, too, in order to clinch proof beyond the point of contestibility. Thus has the search in science been endless and forecasts that it always will be.

In the article as finally published, the whole nature of a science was described as the foundation of a structure on which must be built in time the final edifice. Each new fact gathered and added to the structure could be imagined in the form of a brick—the discoverer, an artisan working temporarily on the project but adding his brick or bricks to the structure, many after and before him, contributing their quota until a respectably sized structure was realized.

Peculiar unto science is the fact that the structure is never near completion, probably never will be completed as there will always be phenomena that man will want to know about and understand so that the structure goes on attaining size.

It has always been a peculiarity of science, particularly of medical science, to withhold acknowledgment of a deed well done, usually a valuable discovery contributed, until long after the original worker has passed on, and has therefore been deprived of any satisfaction and glory he might have enjoyed, had his work been acknowledged during his lifetime. The pages of medical history are full of experiences of men who have uttered truth, which has been accepted by the medical body as a whole only after much controversy, criticism and bitterness.

Another curious custom of medical science is that in many instances, discoveries have lain buried for a long period of time, the original discoverer probably having given up the battle for acceptance of his idea because of sheer mental or physical exhaustion. When some enterprising opportunist comes across such a piece of work and this is usually by accident, such an opportunist adds or changes a word here or there, then announces to the world his own particular little brain child, never giving credit anywhere to a deserving worker in the field, who, having passed on, is not able to present his priority claims

and worse still no one sufficiently interested to do it for him.

All of which leads up to a bit of accidental reading, wherein one could not help but be astonished at the application of this very method of conduct to such a comparatively minor procedure as a gastrostomy; and inasmuch as persons involved in such conduct are contemporarily active, an effort is made herein to review the history of the development of the technics *giving credit where credit is due and establishing priority by the chronological recording of each man's work as established by published printed matter, available at any medical library for corroboration or verification.*

Mindful of the admonition of Moynihan that before writing on any medical subject it would be well to see what Osler may have said on the subject, the bibliography of Osler's writings has been diligently searched but nothing pertinent encountered probably because Osler was primarily a pathologist and clinician and not very much interested in surgical procedures, although we know that he attended Billroth's Clinic diligently while he was in Vienna and even went so far as to do some cadaver surgery with Billroth's assistant and advised many of his medical friends visiting in Europe to do likewise.

It is again a peculiarity of medical science that often a finished discovery is not the work of one man, may even be that of several men working at the same time, unknown to each other, but putting together several pieces, then the addition of the master piece to produce the whole, the original first piece having been discovered by some obscure worker many long years before. Such is the usual story in a finished opus. Witness the story of the development of insulin. One has to go back to De Graaf, Von Haller, Claude Bernard, Pavlov, to name only a few great names contributing their all to knowledge of the pancreas.

Each contributed an important single piece of knowledge of pancreatic physiology. Banting and Best made use of this knowledge, went forward, found the master piece which was missing, and arrived at a goal, insulin. But both men, having accomplished successfully what they set out to do, gave adequate credit to the enormous value of the discoveries of their predecessors in the field. The story of penicillin practically parallels this.

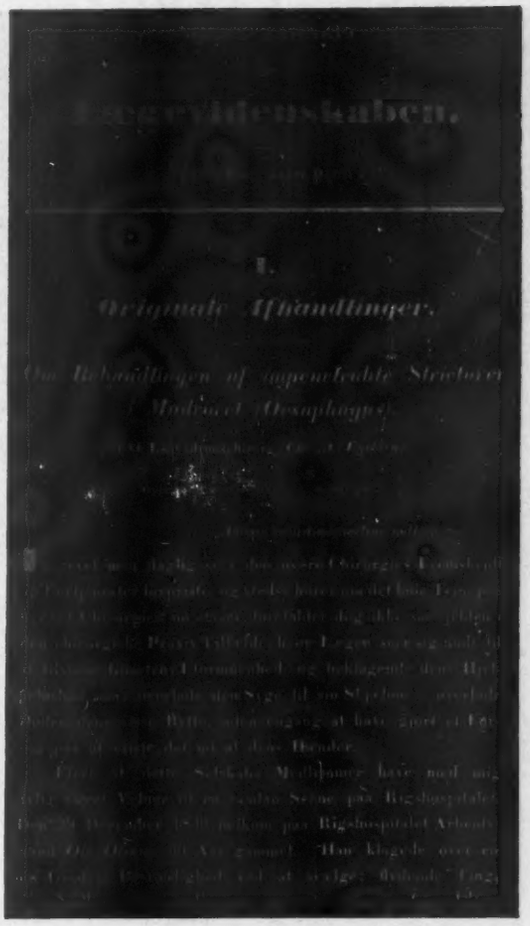


FIG. 1. A, facsimile of title page of Egeberg's lecture in 1837.

The first operation ever done on a human stomach was gastrotomy, which came about as a necessity of the times. Mental deficiency being apparently in much greater prevalence in early days (meaning the fifteenth, sixteenth, and seventeenth centuries) than at any time since, and the swallowing of bizarre objects, accidentally, or as an occupational hazard or otherwise, particularly by members of travelling circuses and shows, being of great frequency, necessity forced the daring needed

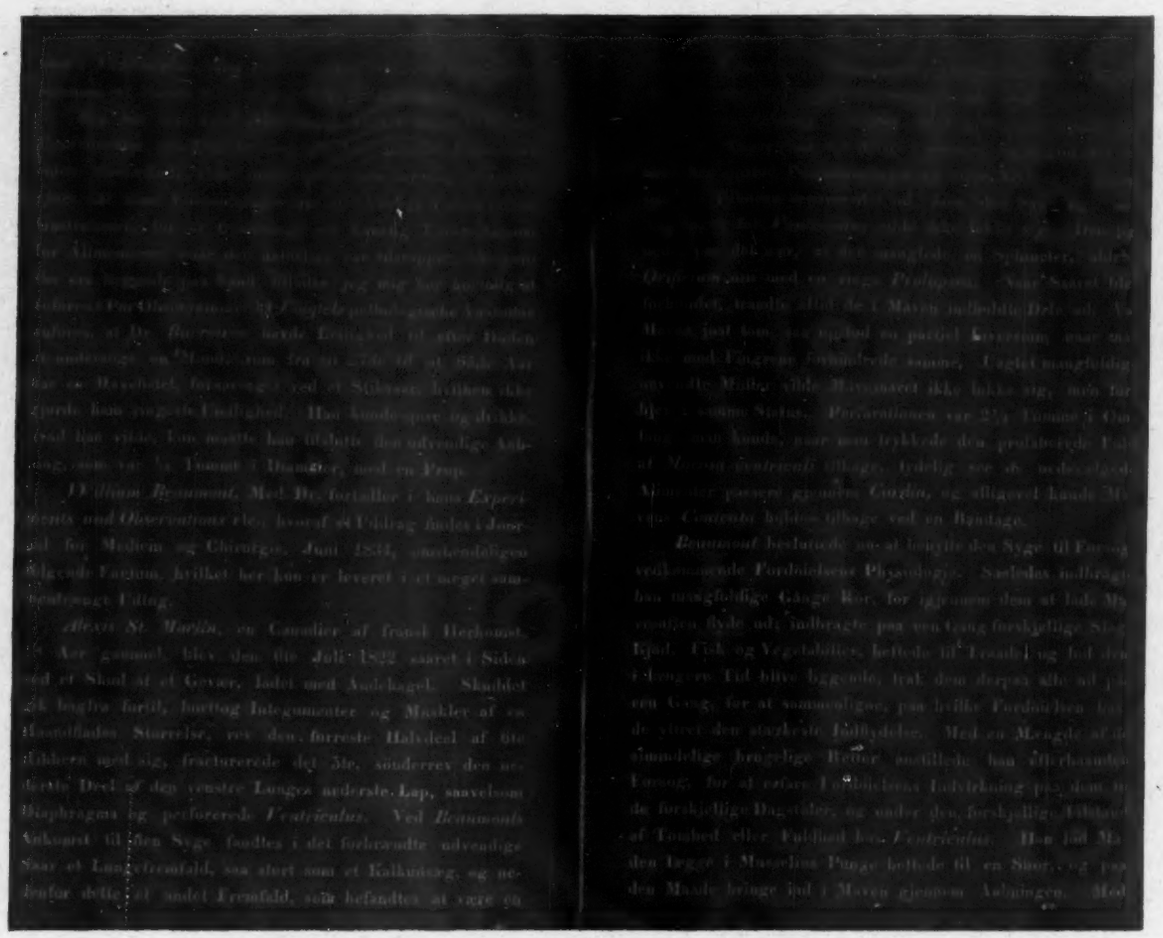


FIG. 1. B, facsimile pages containing the gist of Egeberg's remarks.

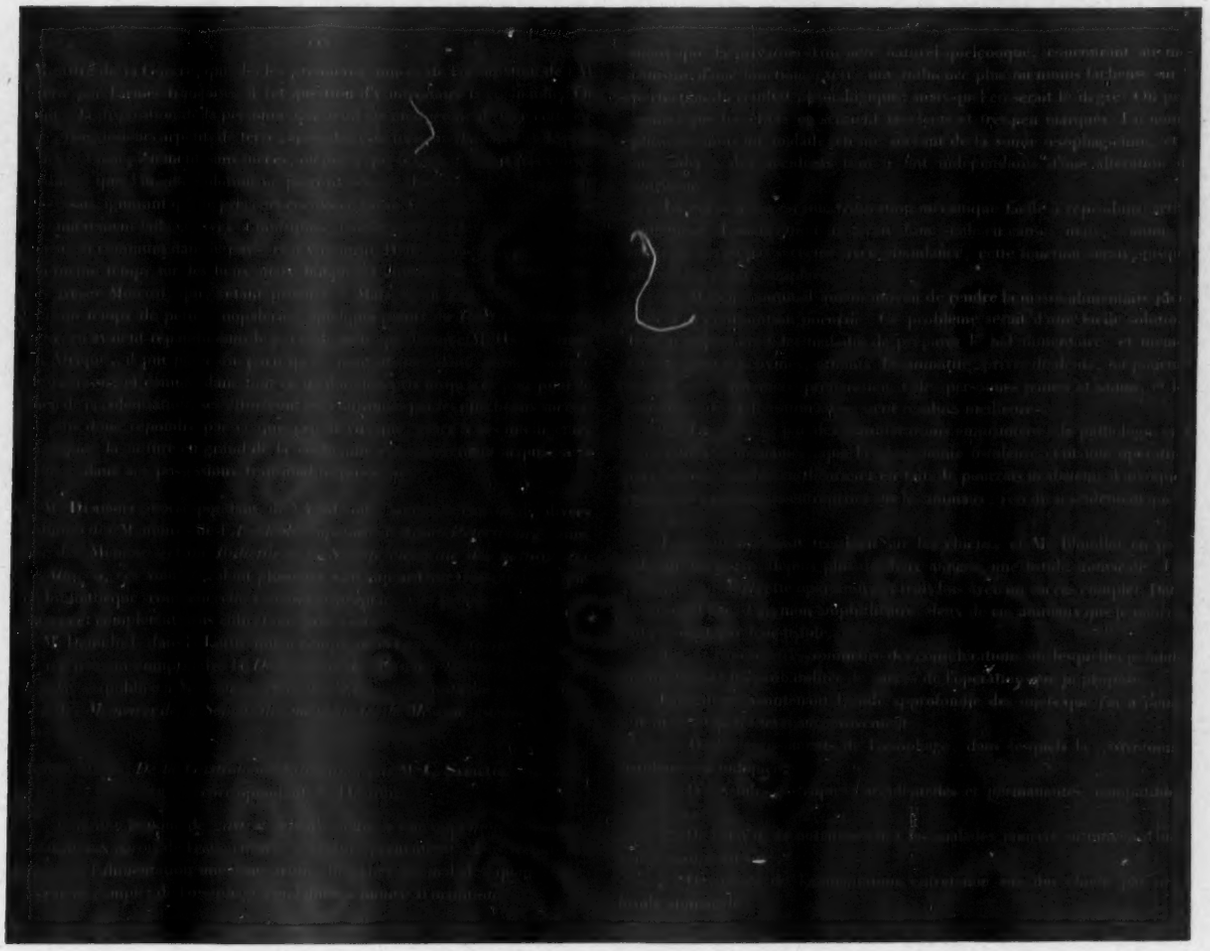
to open the stomach to remove the various and sundry objects within.

One glance at the paintings of the Middle European masters of the sixteenth and seventeenth centuries illustrates that whether or not they knew what they were painting, a large number of hydrocephalics, microcephalics, cretins, and mongolian idiots can be made out in any scene wherein groups of people are painted. This is particularly true in the paintings of the Dutch and German masters, specifically, Holbein and Breughel. But what as to gastrostomy? In order to discuss any subject intelligently it is necessary to have a clear cut definition and picture of it in mind. Gastrostomy consists in the creation of an artificial opening into the stomach from the outside for the purpose of introducing food or medications therein.

Historical accuracy will have to give credit to a Norwegian Army surgeon, named Egeberg[1] for first proposing such an operation in a lecture and anatomical demonstration before Army Officers in Copenhagen in the year 1837. The record is that he was discussing a case of carcinoma of the oesophagus. Details of his proposed approach and technic are not available.

It is well to recall here that the eighteen-thirties were the days of Alexis St. Martin and the United States Army Surgeon Beaumont. This case had received world wide publicity and Doctor Beaumont's own account of his experiences with "fistulous Alex" had been published in 1830 in Plattsburg, New York, was almost immediately received and commented on in London, and the spread of both Beaumont's fame and that of his case to other centers of medicine in Europe was almost instantaneous.

It could well be that Egeberg had either



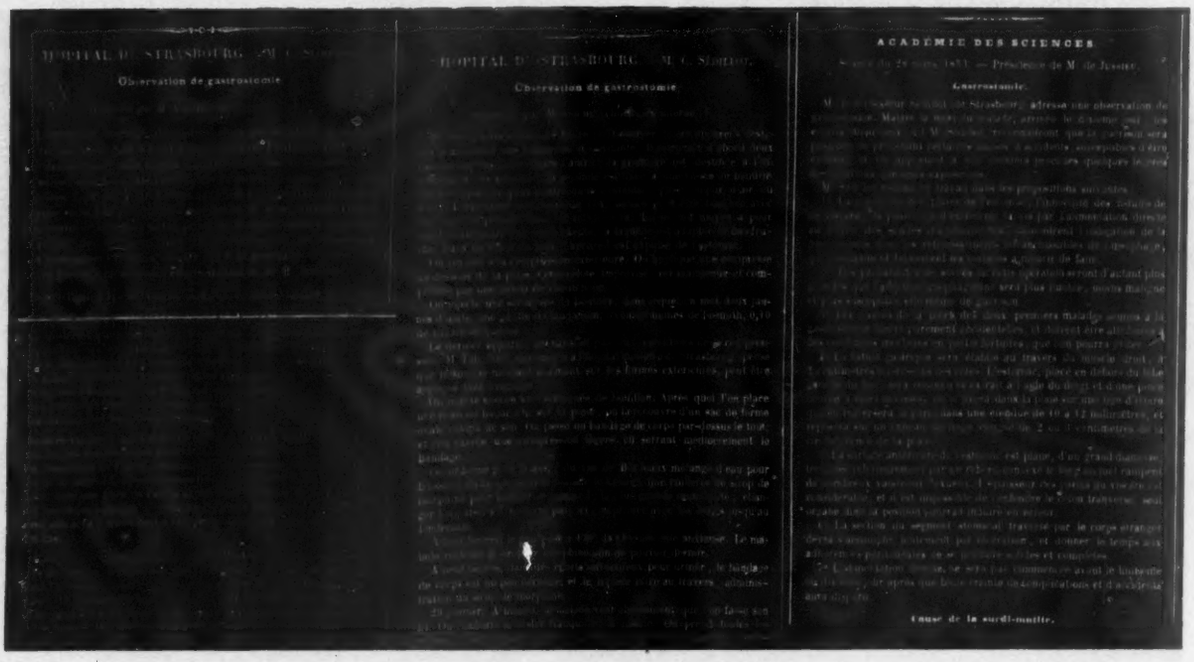
A B

FIG. 2. A and B, facsimile pages of Sédillot of Strasbourg; observations and reports upon gastrostomy.

heard of or read of Alexis and of Beaumont's observations and how he had made them; but it is on record that he advanced as argument for the operation the fact that he knew personally of cases of gastrotomy that had survived, and that he himself could see no reason why if you could operate successfully to take things out of the stomach you could not reverse the procedure and operate to put things in. There exists no record, however, that Egeberg may have tried to do this operation personally, and also no record that he advocated any particular technic for doing it.

Then again it is reasonable to speculate that Egeberg may have been conversant with European reports of other cases similar to Beaumont's. That fiery petrel of New England medicine, Benjamin Waterhouse, had returned from Europe with an account of a case he had seen on the wards of the Allgemeine Krankenhaus in Vienna, which in all respects was similar to Alexis'. Waterhouse, on reporting this case, was immediately challenged as to its authenticity (he would have been challenged on anything he might have said anyway) and had to write to Vienna to obtain proof that he was telling the truth; which he so did. By some trick of fate the publicity flare for Beaumont's case took hold and the Vienna case sank into obscurity. Had it been otherwise, the Vienna case would have antedated Beaumont's by about twenty-five years.

Egeberg, may have had knowledge of this Vienna case, as accounts of it had appeared in Medical Journals throughout Europe, or he may have had knowledge of similar cases elsewhere.



C D E

FIG. 2. C, D and E, facsimile pages of Sédillot of Strasbourg; observations and reports upon gastrostomy.

In 1845, a surgeon named Sédillot,[2] of Strasbourg in France, first performed the operation on three dogs—all of which lived—and he coined the term "gastrostomie fistuleuse" in describing the operation. During the next nine years he performed the operation on human beings three times. All three of these patients died of peritonitis; but undismayed, Sédillot predicted that some day it would be a successful and usable procedure. (Fig. 2.)

In 1853, a Danish Surgeon, Fenger,[3] of Copenhagen, having done the operation on dogs, tried it on a human being who died immediately of peritonitis.

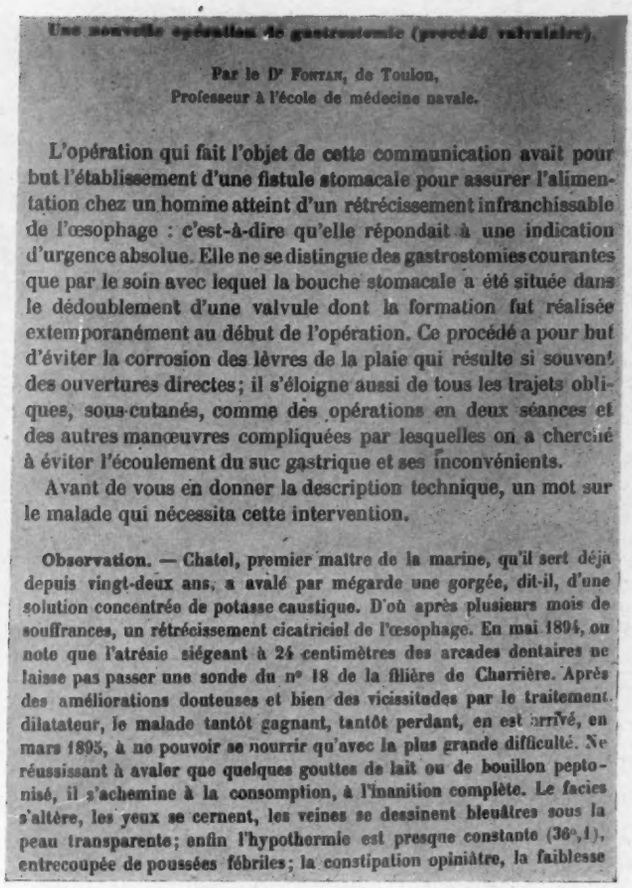
It must be kept in mind that these operations of Sédillot and others were being performed in pre-Listerian days of antisepsis. Secondarily, although none of the surgeons involved speaks of it in extenuation of his failures all of these operations were done in cases of carcinoma of the esophagus, in which no mention is made of the degree of starvation and debilitation the patient was in when he or she arrived at operation.

At any rate, it was recognized then that the operation had its indications and uses. It was necessary to perfect it and rid it of some of those features hindering success. The greatest factor hindering success was of course leakage, which, if it did not cause peritonitis and death, caused a painful and distressing digestion of the skin and superficial tissue on the abdominal wall around the wound.

Someone proposed immediately a modification in the technic of the operation, that it should be done in two stages—the first stage consisting of bringing up a segment of the anterior wall of the stomach and suturing it to the peritoneum, subcutaneous tissue and skin; and then several days later, if the patient had not developed peritonitis, to open the presenting portion of anterior stomach wall and insert a tube. No actual printed article or material could be found to corroborate the above technical proposal.

Such a procedure, although to a minor extent influencing a reduction in the peritonitis rate, did not do away with the skin involvement, which was still sufficiently distressing that further attempts to improve the operation were necessitous.

It would be well to pause right here to give a bit of credit where credit is due. Egeberg first suggested the operation in



Une nouvelle opération de gastrostomie (procédé valvulaire).

Par le Dr Fontan, de Toulon,
Professeur à l'école de médecine navale.

L'opération qui fait l'objet de cette communication avait pour but l'établissement d'une fistule stomacale pour assurer l'alimentation chez un homme atteint d'un rétrécissement infranchissable de l'œsophage : c'est-à-dire qu'elle répondait à une indication d'urgence absolue. Elle ne se distingue des gastrostomies courantes que par le soin avec lequel la bouche stomacale a été située dans le dédoublement d'une valvule dont la formation fut réalisée extemporanément au début de l'opération. Ce procédé a pour but d'éviter la corrosion des lèvres de la plaie qui résulte si souvent des ouvertures directes; il s'éloigne aussi de tous les trajets obliques, sous-cutanés, comme des opérations en deux séances et des autres manœuvres compliquées par lesquelles on a cherché à éviter l'écoulement du suc gastrique et ses inconvénients.

Avant de vous en donner la description technique, un mot sur le malade qui nécessita cette intervention.

Observation. — Chatel, premier maître de la marine, qu'il sert déjà depuis vingt-deux ans, a avalé par mégarde une gorgée, dit-il, d'une solution concentrée de potasse caustique. D'où après plusieurs mois de souffrances, un rétrécissement cicatriciel de l'œsophage. En mai 1894, on note que l'atrésie siégeant à 24 centimètres des arcades dentaires ne laisse pas passer une sonde du n° 18 de la filière de Charrière. Après des améliorations douteuses et bien des vicissitudes par le traitement dilatateur, le malade tantôt gagnant, tantôt perdant, en est arrivé, en mars 1895, à ne pouvoir se nourrir qu'avec la plus grande difficulté. Ne réussissant à avaler que quelques gouttes de lait ou de bouillon peptonisé, il s'achemine à la consomption, à l'inanition complète. Le facies s'altère, les yeux se cernent, les veines se dessinent bleuâtres sous la peau transparente; enfin l'hypothermie est presque constante (36°,1), entrecoupée de poussées fébriles; la constipation opiniâtre, la faiblesse

Fig. 3. Facsimile of Fontan's contribution.

1837, but we can find no record of his having performed the operation, neither did he suggest any technic or approach to accomplish the procedure.

Sédillot, of Strasbourg, actually performed the operation, first on dogs and then on human beings, and actually described an operative technic which he deemed best and there is printed evidence that he actually formulated and put into execution a surgical procedure and plan for doing a gastrostomy. To Sédillot, of Strasbourg, France, should credit for origination be given, based upon complete absence of any plausible claim for priority for anyone else and on the basis of his original article, entitled "De la Gastrostomie Fistuleuse" published in France in 1846, and a second article followed seven years later entitled "Observation de Gastrostomie," in which he related his experience when he performed the operation on three humans. There exists, therefore, actual printed material as described above, ample evidence in any court of opinion, as to who should have the credit as the originator of the operation.

Many great names in medicine had thought about an approach to the stomach, thinking along the same lines that Egeberg did in Christiania in 1837, that if you could cut into the stomach to take out something, why couldn't you cut in to put something in. (Fig. 2A, B, C, D and E.)

If one hies back to the earliest days in medical history, it is of interest that Hippocrates, Galen, Guy de Chauliac, Hugo of Lucca, Lan Franco, and other great personalities speak of operations on the stomach to repair stab wounds and such, but no description of any procedure which might be construed to be a gastrostomy.

Man lived rather precariously in those days, usually by the sword, so that stab wounds of the abdomen were relatively

common. Wars, small and petty though we might label them compared to our twentieth century supercolossal shows, were fought in the main by men on foot with swords or cutting armaments and as a man's abdomen was a very vulnerable piece of anatomy, if it could be reached with a weapon thrust, such procedure insured putting an enemy entirely out of the running immediately and it did not much matter whether he died instantly or just a bit later. That necessity—the repair of cutting penetrating wounds of the abdomen, and not infrequently of the stomach—forced the issue and brought about the first operative procedure on the stomach—gastrorrhaphy—but as it was merely a repair job, priority for first operation is usually given to gastrotomy.

This operative procedure on the stomach cannot truly be said to have been the child of necessity, as certain elective factors were involved. Two basic environmental factors certainly influenced its origination.

The usual form of entertainment available throughout middle Europe in the fifteenth, sixteenth, and seventeenth centuries was the travelling caravan or the circus of the time. Usually these travelling caravans were overbalanced with jugglers, sword swallowers, and similar types. Accidents happened sometimes, and somebody found himself with something swallowed or dropped into the stomach which was not strictly in the routine. What more natural than a fearful rush to some surgeon with the demand that it should be removed, as who could tell what the end result might be. To remove anything from the stomach required cutting into it—ipso facto—gastrotomy. Thus was that operation born.

The other influencing agent is admittedly to some extent conjecture. Not wishing in any way to assume the cloak of an iconoclast, yet a rather diligent search of the medical lore attendant upon the Crusades made such an unfavorable impression that it is a bit excusable if one's reflexes become conditioned to looking upon many happenings of those early days with not only a quizzical, skeptical eye, but also one that is cynically jaundiced.

In the days of ancient Egypt those people who were "in the money" paid fabulous sums for bezoars. Stones found in the bladders or stomachs of animals brought fabulous prices, and stones from certain animals were presumed to be possessed of great power in warding off fevers or pestilence. Others possessed curative properties in epilepsy, scrofula and such. But the most fabulous prices of all were paid for a stone from a human stomach, and those who were able to negotiate to obtain one usually had it set in fine gold and surrounded with precious stones, the finished piece hanging on a chain around the owner's neck, never to be taken off, so that it could always be there to ward off evils, fevers and what not.

Now such a situation could not do otherwise than bring on a bit of skullduggery. Those who cast envious eyes on such a possession were not above indulging in a bit of sword play trying to get possession of it—contributing thereby indirectly to the experience rate of gastrorrhaphy; and the lure of gold and the lust for it has not changed in the human species, so many a clandestine surreptitious gastrotomy might have been done, thereby emboldening certain surgeons to take the next necessary step in answer to the question, "why can't I do this legitimately?" Such a situation could lead to much racketeering as usually happens when there is plenty of money around to pay for it.

The next step in the orderly evolution of the science brings us back to about the year 1856, and those who came after Sédillot. He had published the two articles mentioned relative to his procedure—one in 1846, in the Gazette de Strasbourg, and one in 1853, in the Gazette d'Hopitaux. Because of the two handicaps of Sédillot's procedure, peritonitis and skin digestion, it was only natural that someone should try to improve on his technic.

We then find a long list of names asso-

ciated with this attempt at improvement of the operation, a seemingly all too long list: Von Hacker, Czerny, Witzel, Stamm, Kader, Kocher, Dépage, Janeway, Senn, Ssbanajeff, Jianu and Hahn. All believed according to their published articles that whatever particular wrinkle they personally contributed to the original operation had made it work perfectly, at least in their estimation; yet a fair but critical analysis cannot fail to give one an impression that some of these men, simply by reversing the suture technic or by placing an eccentric row of sutures instead of the orthodox and accepted way, hoped to reap unto themselves much unearned credit. In other words, one wonders if they were not more interested in "crashing the headlines." In the list of names just mentioned, one name has been purposely withheld, that of a Frenchman named Fontan.

Sédillot,[2] in publishing his experience with gastrostomy on animals and humans, gave to the operation the name of "gastrostomie fistuleuse"; and it was known as such by subsequent French surgeons who contributed additional steps in the technic, endeavoring always to perfect the operation and rid it of some of its deficiencies.

Fontan,[4] a brilliant Strasbourg surgeon, realizing that the operation had very definite indications and uses, made first a series of animal experiments, all directed toward making the fistulous tract leakproof and thereby avoiding the excoriation of the skin.

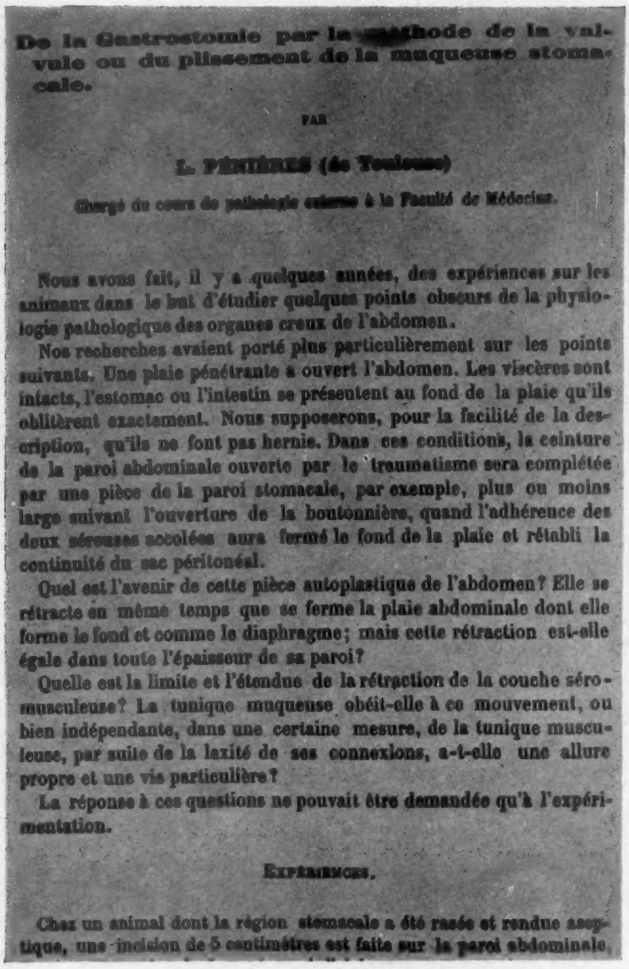
He availed himself of the principles worked out by two contemporary French surgeons, namely, Peliére of Toulouse and Pénières,[5] in their respective laboratories, but it was he personally who really perfected the procedure to such an extent at least that in French surgical literature the operation and technic were constantly referred to as the Fontan operation and the particular method of manufacturing a valve device from the stomach walls the "Fontan valve."

So along with the pioneer work of Sédillot, of Peliére and Péniéres, the perfecting of a serviceable gastrostomy free from at least one of the two deficiencies of heretofore, must be given to Fontan.[4] (Fig. 3.)

Recapitulating, Egeberg, must be given credit for first suggesting the possibility of using the operation for human alleviation and then to Sédillot for devising and perfecting an operative technic for actually doing the operation (although with certain deficiencies), and then to Fontan for having recognized the deficiencies and, in the course of working to overcome them, perfecting a technic for performing the operation in such a manner that the fistulous tract into the stomach had a valve-like mechanism at its stomach end which acted to prevent both leakage and seepage, thereby eliminating the distressing postoperative skin sequelae.

It must be credited to both Sédillot and Fontan that they recognized the high mortality they had experienced in performing the operation on humans as entirely out of line with the severity of the operation, and suggested that patients with esphogeal stricture should be subjected to the operation early, not after a period of starvation when their natural body resistance had been reduced to nil; and what in the ordinary course of events might have been an infection thrown off by a body possessing normal resistance, became a rapidly progressing peritonitis with early death.

In 1930, with pleasure and intellectual profit, I paid a visit to Graz, in the province of Styria in Austria. Professor Denk was chief of surgery at the University. (This is the Prof. Denk who it is said, committed suicide on the day that the Nazis entered Vienna.) It seemed that a quaint custom had been conditioned into the young female contingent in that province (the bobby soxers, so to speak) that whenever the boy friend did not stand by his commitments, recourse was immediately had to a jar of lye, which was kept in all of the houses around the countryside in order to keep their stone floors and tiling clean, and a goodly portion swallowed. The result was



De la Gastrostomie par la méthode de la valvule ou du plissement de la muqueuse stomacale.

PAR

L. PÉNIÈRES (de Toulouse)

Chargé du cours de pathologie externe à la Faculté de Médecine.

Nous avons fait, il y a quelques années, des expériences sur les animaux dans le but d'étudier quelques points obscurs de la physiologie pathologique des organes creux de l'abdomen.

Nos recherches avaient porté plus particulièrement sur les points suivants. Une plaie pénétrante a ouvert l'abdomen. Les viscères sont intacts, l'estomac ou l'intestin se présentent au fond de la plaie qu'ils oblitèrent exactement. Nous supposerons, pour la facilité de la description, qu'ils ne font pas hernie. Dans ces conditions, la ceinture de la paroi abdominale ouverte par le traumatisme sera complétée par une pièce de la paroi stomacale, par exemple, plus ou moins large suivant l'ouverture de la boutonnière, quand l'adhérence des deux séreuses accolées aura fermé le fond de la plaie et rétabli la continuité du sac péritonéal.

Quel est l'avenir de cette pièce autoplastique de l'abdomen? Elle se rétracte en même temps que se ferme la plaie abdominale dont elle forme le fond et comme le diaphragme; mais cette rétraction est-elle égale dans toute l'épaisseur de sa paroi?

Quelle est la limite et l'étendue de la rétraction de la couche séro-musculeuse? La tunique muqueuse obéit-elle à ce mouvement, ou bien indépendante, dans une certaine mesure, de la tunique musculeuse, par suite de la laxité de ses connexions, a-t-elle une allure propre et une vie particulière?

La réponse à ces questions ne pouvait être demandée qu'à l'expérimentation.

EXPÉRIENCES.

Chez un animal dont la région stomacale a été rasée et rendue aseptique, une incision de 5 centimètres est faite sur la paroi abdominale,

FIG. 4. Facsimile of Pénières' contribution.

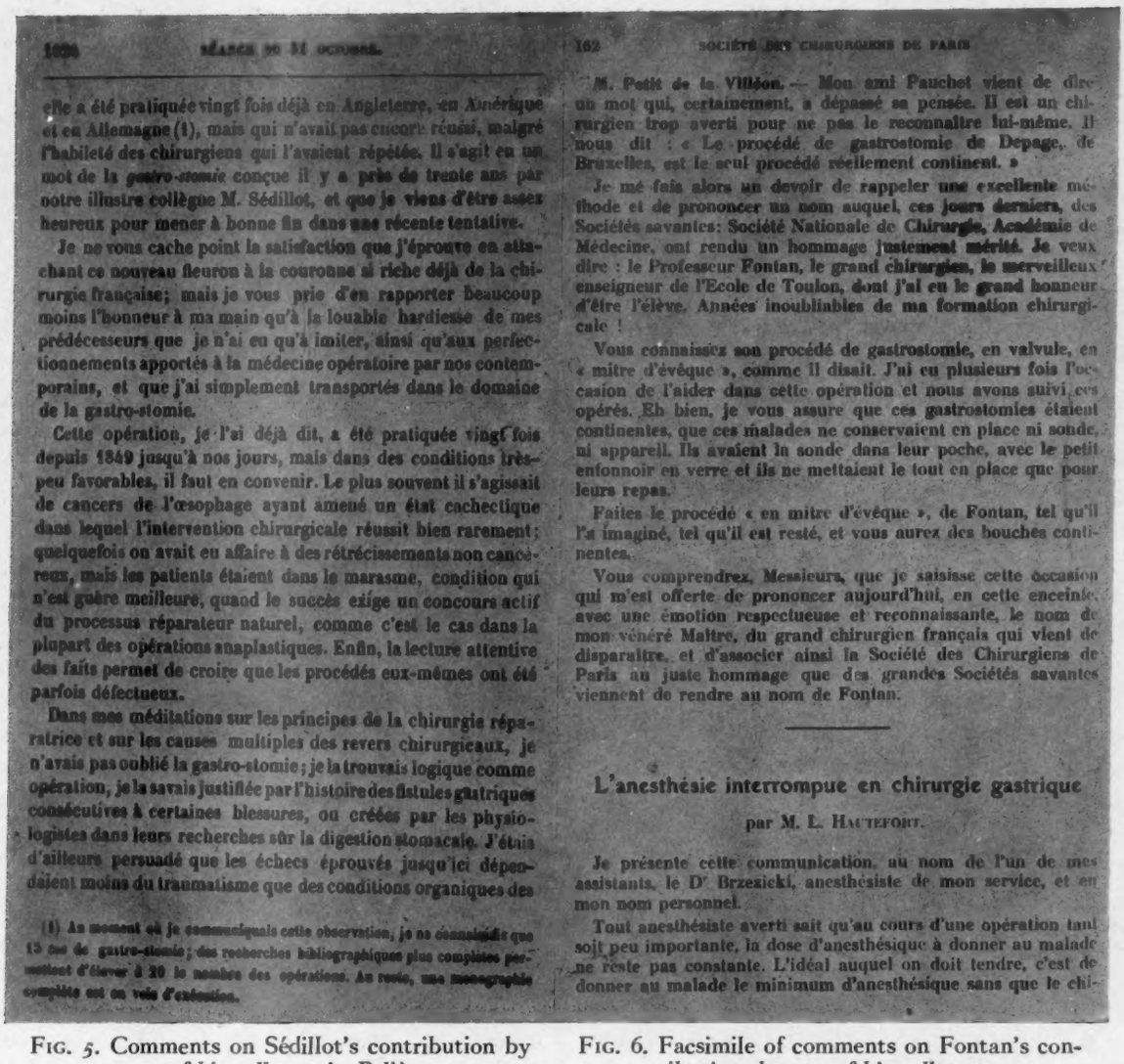
that Denk at all times had an unusual number of cases of stricture of the esophagus from the corrosive effects of the lye.

It was the rule in his clinic to do a gastrostomy on these cases, and to start feeding them as soon as they had recovered from the acute symptoms of the lye poisoning, which was generally in seven to twelve days, and he constantly advocated that the earlier the operation was done the better. In the cases of carcinoma of the esophogus it went without saying that the earlier the better, thereby harking back to the pleas of Sédillot and Fontan that they would have liked to do their operation under more favorable conditions before it was judged harshly and possibly discarded.

In discussing Fontan's contribution to the technic of the operation, mention was made of his use of the work of two contemporary French surgeons. Let us see what Pénières contributed.

Pénières' contribution was published in one of the Paris surgical journals in April, 1893, under the title "De la Gastrostomie par la methode de la valvule ou du plissemont de la muceuse stomachale." It is of historical and bibliographical interest that this article, published in Paris in 1893, is the first published reference to the formation of a valve in the operative procedure. Fontan's article was published in the proceedings of the Tenth Congress of Surgery in France in 1896, three years after Pénières' contribution.

In Pénières'[5] description of his operative technic he made it quite obvious that his efforts were directed toward preventing seepage and regurgitation of the gastric content through the gastrostomy on the stomach wall. An attempt will be made to



elle a été pratiquée vingt fois déjà en Angleterre, en Amérique et en Allemagne (1), mais qui n'avait pas encore réussi, malgré l'habileté des chirurgiens qui l'avaient répétée. Il s'agit en un mot de la *gastro-stomie* conçue il y a près de trente ans par notre illustre collègue M. Sédillot, et que je viens d'être assez heureux pour mener à bonne fin dans une récente tentative.

Je ne vous cache point la satisfaction que j'éprouve en attachant ce nouveau fleuron à la couronne si riche déjà de la chirurgie française; mais je vous prie d'en rapporter beaucoup moins l'honneur à ma main qu'à la louable hardiesse de mes prédécesseurs que je n'ai eu qu'à imiter, ainsi qu'aux perfectionnements apportés à la médecine opératoire par nos contemporains, et que j'ai simplement transportés dans le domaine de la gastro-stomie.

Cette opération, je l'ai déjà dit, a été pratiquée vingt fois depuis 1849 jusqu'à nos jours, mais dans des conditions très-peu favorables, il faut en convenir. Le plus souvent il s'agissait de cancers de l'œsophage ayant amené un état cachectique dans lequel l'intervention chirurgicale réussit bien rarement; quelquefois on avait eu affaire à des rétrécissements non cancéreux, mais les patients étaient dans le marasme, condition qui n'est guère meilleure, quand le succès exige un concours actif du processus réparateur naturel, comme c'est le cas dans la plupart des opérations anaplastiques. Enfin, la lecture attentive des faits permet de croire que les procédés eux-mêmes ont été parfois défectueux.

Dans mes méditations sur les principes de la chirurgie réparatrice et sur les causes multiples des revers chirurgicaux, je n'avais pas oublié la gastro-stomie; je la trouvais logique comme opération, je la savais justifiée par l'histoire des fistules gastriques consécutives à certaines blessures, ou créées par les physiologistes dans leurs recherches sur la digestion stomacale. J'étais d'ailleurs persuadé que les échecs éprouvés jusqu'ici dépendaient moins du traumatisme que des conditions organiques des

(1) Au moment où je communiquais cette observation, je ne connaissais que 15 cas de gastro-stomie; des recherches bibliographiques plus complètes permettent d'élever à 20 le nombre des opérations. Au reste, une monographie complète est en voie d'exécution.

M. Petit de la Villéon. — Mon ami Pauchet vient de dire un mot qui, certainement, a dépassé sa pensée. Il est un chirurgien trop averti pour ne pas le reconnaître lui-même. Il nous dit : « Le procédé de gastrostomie de Depage, de Bruxelles, est le seul procédé réellement continent. »

Je me fais alors un devoir de rappeler une excellente méthode et de prononcer un nom auquel, ces jours derniers, des Sociétés savantes: Société Nationale de Chirurgie, Académie de Médecine, ont rendu un hommage justement mérité. Je veux dire : le Professeur Fontan, le grand chirurgien, le merveilleux enseigneur de l'Ecole de Toulon, dont j'ai eu le grand honneur d'être l'élève. Années inoubliables de ma formation chirurgicale !

Vous connaissez son procédé de gastrostomie, en valvule, en « mitre d'évêque », comme il disait. J'ai eu plusieurs fois l'occasion de l'aider dans cette opération et nous avons suivi ces opérés. Eh bien, je vous assure que ces gastrostomies étaient continentes, que ces malades ne conservaient en place ni sonde, ni appareil. Ils avaient la sonde dans leur poche, avec le petit entonnoir en verre et ils ne mettaient le tout en place que pour leurs repas.

Faites le procédé « en mitre d'évêque », de Fontan, tel qu'il l'a imaginé, tel qu'il est resté, et vous aurez des bouches continentes.

Vous comprendrez, Messieurs, que je saisisse cette occasion qui m'est offerte de prononcer aujourd'hui, en cette enceinte, avec une émotion respectueuse et reconnaissante, le nom de mon vénéré Maître, du grand chirurgien français qui vient de disparaître, et d'associer ainsi la Société des Chirurgiens de Paris au juste hommage que des grandes Sociétés savantes viennent de rendre au nom de Fontan.

L'anesthésie interrompue en chirurgie gastrique

par M. L. Hautefort.

Je présente cette communication, au nom de l'un de mes assistants, le Dr Brzezicki, anesthésiste de mon service, et en mon nom personnel.

Tout anesthésiste averti sait qu'au cours d'une opération tant soit peu importante, la dose d'anesthésique à donner au malade ne reste pas constante. L'idéal auquel on doit tendre, c'est de donner au malade le minimum d'anesthésique sans que le chi-

FIG. 5. Comments on Sédillot's contribution by one of his colleague's, Pelière.

FIG. 6. Facsimile of comments on Fontan's contributions by one of his colleagues.

follow the step by step modification and perfecting of the procedure, each worker attempting to overcome some obstacle, until gradually there is evolved the procedure as it is known today.

Pénières[5] said that a valve composed of mucous membrane fulfilled its intended function when it prevented the escape of gastric juice. He believed that he had accomplished this by the technic which he described, in that following operation there had been neither inflammation nor ulceration of the skin, proving thereby that the gastric juice had been confined to the stomach and had been unable to escape therefrom. (Fig. 4.)

Pelière was an experimental pathologist. He was interested in the problem technically and in the perfection of the procedure, but more in the nature of an experimental piece of laboratory research than in a technic for human adaptation; although he fully realized the uses for such a procedure. His work, therefore, was confined to laboratory research, experiments on dogs, and he did no operations on the human body. (Fig. 5.)

Fontan,[4] in his article, was careful to acknowledge the preliminary contributions of both Pelière and Pénières, and to indicate that his method differed from any other hitherto advanced, in that whereas his predecessors had made their valve from the mucosal lining of the stomach alone,

he made his from all three layers of the stomach wall including the serosa, and he had every reason to believe that it would be stronger in construction and therefore function better, which it evidently did.

That the procedure was satisfactory, not only to Fontan himself, but to his associates and assistants, is attested to by the fact that almost forty years later one of his early assistants, in a discussion of Dépage's technic for gastrostomy, got up and defended Fontan before the august Society of Surgeons of Paris, at one of its meetings, against the previously enunciated eulogy of Dépage by M. Pauchet. Dépage was then at the height of his fame and position in French surgery, particularly Parisian surgery, and indirectly in the process of claiming also some part in the origination of the technique then known.

The following is taken from the "Bulletin et memoires de Société de Chir. de Paris, vol. 32, March 6, 1931, and was by M. Petit de la Villeon.[6] (Fig. 6.)

Along about the early nineties the operative procedure was attracting attention in America, and American surgeons were adding their efforts toward perfecting the technic. The surgical literature tells us that the first gastrostomy done in America was by a Philadelphia surgeon named Maury. Although the result was not successful, Dr. Maury was impressed with its possibilities and said: "So great is my conviction that the procedure is justifiable that I would have no hesitancy in resorting to it in any case of impending starvation from non-cancerous stricture of the esophagus, provided malnutrition had not reached a stage which rendered the case hopeless."

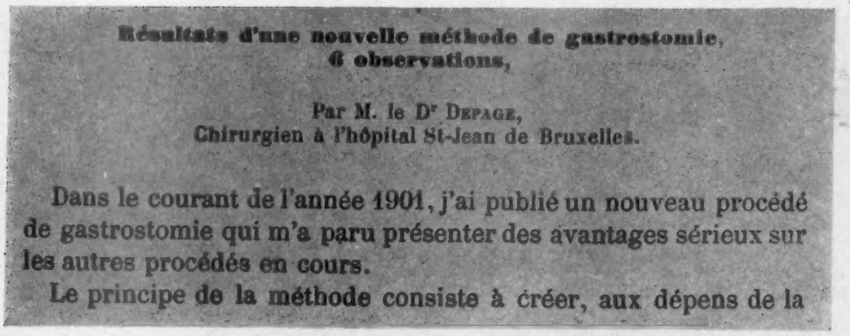
In 1894, Edmund and Willys Andrews,[7] professors of clinical surgery at Northwestern University, published an account of their research and study and clinical experience with their own technic of a gastrostomy made with a mucuous membrane lining.

The first successful gastrostomy—that is, wherein the patient lived after operation—was done in 1876, by a surgeon named Verneuil.[8] In his description of his technic and report of his success he searched the literature, and up to that time he was able to find twenty authenticated cases in which the operation had been done, but not a single successful case.

However, this can be explained on the basis that practically every case up to his time had been done for malignant obstruction of the esophagus on patients badly depleted by the disease and offering very poor surgical risk, whereas, in his successful case it had been done for a non-malignant stricture in a patient presenting a fairly average degree of risk only.

One arrives now at a stage in the development or evolution of a technic which is rather the usual in almost all scientific efforts. The need for a procedure has forced its discovery, then drawbacks in its original conceptions have forced men to seek better, more perfect ways in which to make the procedure more adaptable and with a greater degree of safety to the human individual needing such a procedure. Therefore, we have attained successfully the following steps in procedure: first, the establishment of the indications for such an operation as gastrostomy; secondly, origination of a technic for performing that operation; and for these first two steps we must give full credit to Egeberg in Norway, and Fontan in France.

The next step is the elimination of defects present in the technic up to that time, most prominent being the problem of leakage and skin digestion about the attachment of the gastrostomy fistula to the skin. So we find men devoting their attention to the development of valvular arrangements in order to render the valve tight and avoid leakage. Historical accuracy demands that we must give full credit to Pénières[5] and Fontan[4] for a satisfactory solution of this phase. The associated handicaps of peritonitis and infection were to be remedied not strictly by anyone directly associated with the task of making a better gastrostomy, but by the development of antiseptic surgery by Lister



Résultats d'une nouvelle méthode de gastrostomie, 6 observations,

Par M. le Dr Depage,
Chirurgien à l'hôpital St-Jean de Bruxelles.

Dans le courant de l'année 1901, j'ai publié un nouveau procédé de gastrostomie qui m'a paru présenter des avantages sérieux sur les autres procédés en cours.

Le principe de la méthode consiste à créer, aux dépens de la

Fig. 7. Facsimile of title page of Depage's contribution.

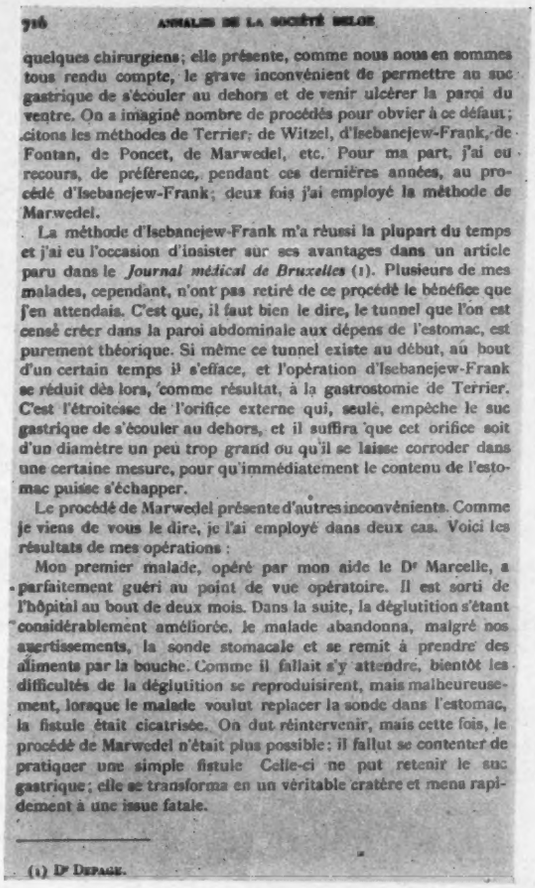
and indirectly by those men who were doing gastrostomies, recognizing that their chances for success were greater if the operation were done earlier, whether in cases of stricture of the esophagus following ingestion of corrosives or from malignant disease.

That brings us into a new phase in the development of the operation—a stage characterized by refinements in technic—the development of technical approaches aimed at simplifying and shortening the time of performing the operation, attempts at making the tightness and efficacy of the valve construction more certain, and also attempts at correcting some of the more minor flaws still present in the operation.

We come now to a series of names more or less familiar in the field of gastric surgery, names such as Von Hacker,[9] Witzel,[10] Stamm,[11] Kader,[12] Marwedel,[13] and Dépage in France.

Ending this list of names with that of Dépage is done with a purpose, as this comprises the period which was devoted to refinements in the technic as mentioned above, aimed at performing a better operation in quicker time and with resultant increased benefit to the patient. (Figs. 7 and 8.)

Von Hacker's contribution consisted of bringing up a portion of the anterior wall of the stomach through the fibers of the rectus abdominis muscle and hoping that the pressure of this voluntary muscle would act as a valve and keep the gastrostomy leak-proof. His tube was lined with stomach mucosa and had the drawback that it often tended to close and also that the compression action of the rectus fibers was not all that Von Hacker expected, and he still had considerable wound and skin difficulty. Von Hacker's work was done in Vienna between 1884 and 1890. Finsterer, who had been Von Hacker's pupil and later his assistant as late as 1930, to my knowledge, performed all gastrostomies according to Von Hacker's technic, despite his frequent postoperative grief. His argument was that he could do it cleanly and quickly; therefore, he preferred it, although in doing a



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quelques chirurgiens; elle présente, comme nous nous en sommes tous rendu compte, le grave inconvénient de permettre au suc gastrique de s'écouler au dehors et de venir ulcérer la paroi du ventre. On a imaginé nombre de procédés pour obvier à ce défaut; citons les méthodes de Terrier, de Witzel, d'Isebanejew-Frank, de Fontan, de Poncet, de Marwedel, etc. Pour ma part, j'ai eu recours, de préférence, pendant ces dernières années, au procédé d'Isebanejew-Frank; deux fois j'ai employé la méthode de Marwedel.

La méthode d'Isebanejew-Frank m'a réussi la plupart du temps et j'ai eu l'occasion d'insister sur ses avantages dans un article paru dans le *Journal médical de Bruxelles* (1). Plusieurs de mes malades, cependant, n'ont pas retiré de ce procédé le bénéfice que j'en attendais. C'est que, il faut bien le dire, le tunnel que l'on est censé créer dans la paroi abdominale aux dépens de l'estomac, est purement théorique. Si même ce tunnel existe au début, au bout d'un certain temps il s'efface, et l'opération d'Isebanejew-Frank se réduit dès lors, comme résultat, à la gastrostomie de Terrier. C'est l'étroitesse de l'orifice externe qui, seule, empêche le suc gastrique de s'écouler au dehors, et il suffira que cet orifice soit d'un diamètre un peu trop grand ou qu'il se laisse corroder dans une certaine mesure, pour qu'immédiatement le contenu de l'estomac puisse s'échapper.

Le procédé de Marwedel présente d'autres inconvénients. Comme je viens de vous le dire, je l'ai employé dans deux cas. Voici les résultats de mes opérations :

Mon premier malade, opéré par mon aide le Dr Marcelle, a parfaitement guéri au point de vue opératoire. Il est sorti de l'hôpital au bout de deux mois. Dans la suite, la déglutition s'étant considérablement améliorée, le malade abandonna, malgré nos avertissements, la sonde stomacale et se remit à prendre des aliments par la bouche. Comme il fallait s'y attendre, bientôt les difficultés de la déglutition se reproduisirent, mais malheureusement, lorsque le malade voulut replacer la sonde dans l'estomac, la fistule était cicatrisée. On dut réintervenir, mais cette fois, le procédé de Marwedel n'était plus possible; il fallut se contenter de pratiquer une simple fistule. Celle-ci ne put retenir le suc gastrique; elle se transforma en un véritable cratère et mena rapidement à une issue fatale.

(1) Dr Depage.

Fig. 8. Facsimile of the gist of Depage's remarks.

Centralblatt
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No. 32. Sonnabend, den 8. August. 1891.
Inhalt: I. Witzel, Zur Technik der Magenfistelanlegung. — II. Kölliker, Winkelschiene für Oberschenkelbrüche. (Original-Mittheilungen.)
1) Gerlach, Lysol. — 2) Bayerthal, Meningocele traumatica. — 3) Scheibe, Borsäure bei Mittelohrerkrankung. — 4) Haug, Lysol und Naphthol bei Ohrleiden. — 5) Zaufal, Fremdkörper in der Paukenhöhle. — 6) Scheff, Zahnheilkunde. — 7) Cowder, Abscesse der Säuglinge. — 8) Frommel, Antiseptik bei Laparotomien. — 9) Finkelstein, Brucheinklemmung. — 10) Hagenl, Radikalbehandlung der Leistenbrüche. — 11) Zuckerkandl, Brüche im Douglas'schen Raum. — 12) Fort, Harnröhrenenge. — 13) Sadlischtschow, Steinschnittmethoden. — 14) Delagénière, 15) Gernays, Hysteropexie. — 16) Blaise, Gebärmutterexstirpation. — 17) Séjournel, Hydrocele der Neugeborenen. — 18) Ribbert, Kompensatorische Hypertrophie der Geschlechtsdrüsen.
19) Neupert, Antiinfektiöse. — 20) Pittarelli, Aspirator-Injektor. — 21) Nolin, Beiträge zur Chirurgie. — 22) Kummer und Christiani, Tuberculo dolorosa. — 23) Bally, Kropf. — 24) Ransom, Fremdkörper im Kehlkopf. — 25) Cone, 26) Cohen, Brustdrüsengeschwulst. — 27) Blajmer, Empyem der Pleura. — 28) v. Bonsdorff, Bauchschüsse. — 29) Lindner, Herniotomie. — 30) Wolf, Radikaloperation der Brüche. — 31) Koch, Fettgeschwülste im Hodensack. — 32) Brown, Harnröhrengeschwulst. — 33) Casati, Gebärmutterexstirpation. — 34) Bryant, Aneurysma der A. subclavia. — 35) Putti, Exstirpation des Schulterblattes. — 36) Damoiseau, Missbildung der Hand. — 37) Motta, Arthrodese. — 38) Bonardi, Mal perforant.
II. Dermatologen-Kongress.

I. Zur Technik der Magenfistelanlegung.
Von
Prof. Oscar Witzel, Bonn.
Die Mittheilungen über die Anlegung einer Ernährungsfistel am Magen sind in der letzten Zeit seltener geworden. Die Operation ist in die Reihe der allseitig als berechtigt anerkannten und vielfach geübten eingetreten, und es steht auch statistisch fest, dass durch dieselbe positiv Nutzen geschaffen wird. Dennoch schreitet wohl kein Chirurg ohne ein gewisses Zögern zur Ausführung derselben, sofern es nicht gilt, den unmittelbar drohenden Erschöpfungstod abzuwenden. Dieses Zaudern ist bedingt durch die Unsicherheit des

FIG. 9. Facsimile of title page of Witzel's article on gastrostomy. (Note date of publication.)

jejunostomy or an enterostomy he used the Witzel technic.

The Witzel technic (Fig. 9) is familiar to all interested in gastric surgery and hardly needs any detailed description here. Suffice it to say that the canal by this procedure is lined with serosa and tends to obliterate and close.

Next followed a flurry of ideas along two different lines, but both directed toward the same objective the avoidance of leakage and making the gastrostomy tube fluid tight.

The first group tried using the highest fibers of the rectus muscles for compression; and another group tried to bring up a tent of the anterior wall of the stomach through the costal cartilages and to use the actual squeezing and compression power of the cartilages or of intercostal muscle fibers to accomplish their end. These naturally were outcroppings of Von Hacker's first ideas; all were serosa lined with the already named serosal dificiencies.

Another group built their gastrostomy technic around a tubular valve and purse-string sutures, varying Witzel's method a bit by the manner in which they inserted the tubes; and here we find men putting in two purse-string sutures, one above the other and calling it a new operation and that two sets of valves were formed by this method, and then others putting in three purse-string sutures, one above the other, also calling it a new technic, a new operation, and that better and more efficient

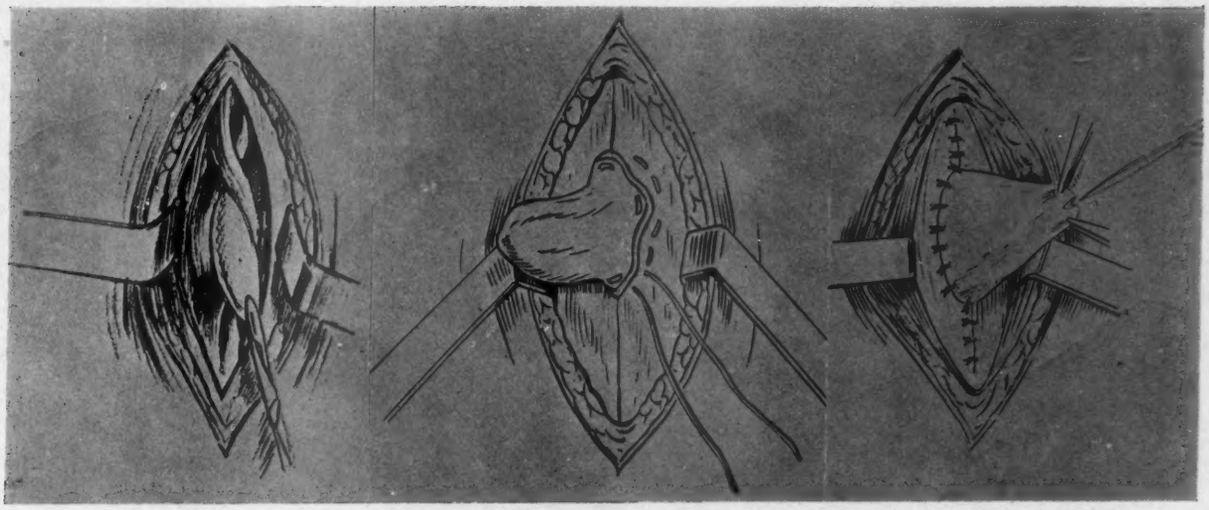


Fig. 10. Fig. 11. Fig. 12.

Fig. 10. Gastrostomy as "originated" by several surgeons attempting to use the longitudinal rectus abdominus fibers as a constricting force notably one Girard, a French surgeon.

Fig. 11. Gastrostomy as advocated by another Frenchman consists of bringing a cone of the stomach through the split rectus abdominus, wishfully hoping that the constricting action of the rectus muscle would counteract spillage and leakage.

Fig. 12. An illustration from articles by various French surgeons, wherein the procedure of bringing a cone of anterior stomach wall through the rectus was utilized. (So many names are attached to this particular procedure, that the number is too great to enumerate here.)

valvular action had been achieved. It is readily admitted that in all of these technical approaches leakage and spillage had been overcome to varying degrees.

These were the methods of Stamm, Kader, Marwedel and Heussner, representing only one man's idea of doing another man's operation, which brings the subject up to Dépage's[14] contribution in 1901.

Inasmuch as Dépage's contribution to the technical progress of the gastrostomy operation constitutes a sort of milestone, it might be well to recapitulate what had taken place up to his time in development of the procedure.

Egeberg, who first proposed the operation in a lecture before a medical society, in Copenhagen, gets and is entitled to credit and priority for his part. Next, a technic was developed by experimentation with animals and that the operation was then done on humans with at first invariably fatal results; but finally a few successes by various surgeons were reported. For this phase the French surgeons, Pénières and Fontan receive priority and credit. The next steps were refinements of technic proposed by various men to overcome deficiencies, such as infection within, peritonitis, wound infection and digestion of tissue because of non-continence or faulty continence of the tube.

To the two Frenchmen, Pénières and Fontan, must be given credit for evolving a water-tight and continent valve-like arrangement.

Then came more procedures, all directed toward circumventing this incontinence. We find men bringing up a tent of anterior wall of the stomach through rectus abdominis muscles, hoping for satisfactory voluntary pressure control; then other men bringing a similar segment of stomach wall out through the lower intercostals with the same objective in view, in other words, trying to solve the problem of continence of the tube, it being paramount that it should be water-tight.

Still another deficiency was present, however, the early closure of the fistula tract by the walls coming together and healing so that sounding and dilatation were later necessary; and when such was necessary, the old problem of continence popped up.

So we come to various men originating tube formations lined with mucosa.

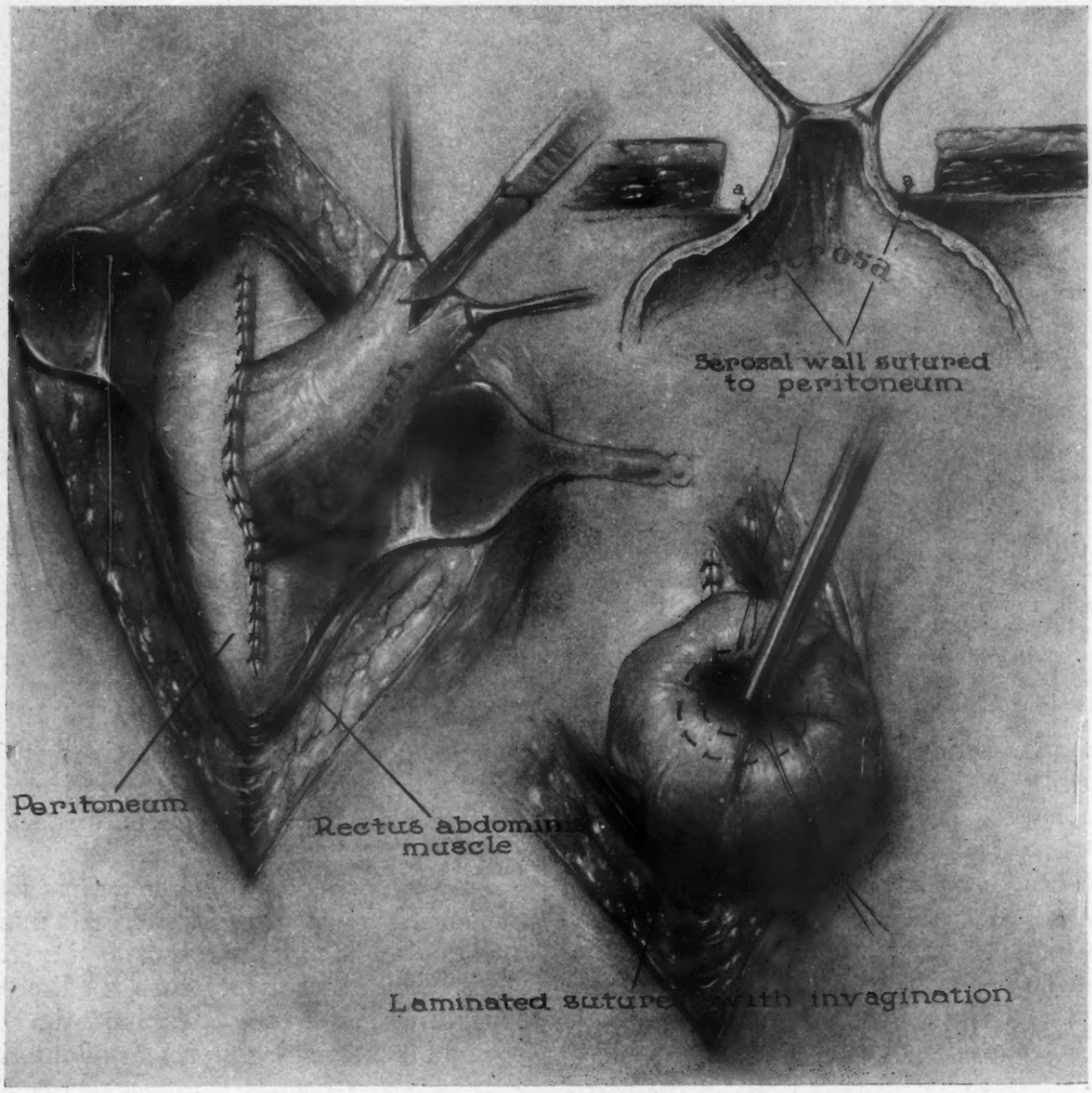


Fig. 13. Methods used for overcoming leakage and spillage.

Dépage[14] *contributed the tube features of a continent and functionally efficient gastrostomy, and should be given credit for it even though an American, Janeway, apparently working on the same procedure, presumably with no knowledge of the other's work, came forth in* 1913 *with an almost identical technic, announced as a new one.*

Janeway's[16] article appeared not in an American Journal, but in the *Münchener Medizenische Wochenschrift* in 1913, twelve years after Dépage's original article. *Priority seems rightfully to belong to Dépage.*

One dislikes to write the following, but obeying the precepts of "science knows no geographical boundaries" (perhaps we should add "nor ethnological or racial ones either"), it was a Japanese surgeon, Watsudjii,[17] who really first combined a tube and a valve technic and deliberately wrote that he had done so, although he varied his technic a little in order to satisfy his sense of originality, and as Von Hacker had only recently announced his contribution to the technic of the operation, the Japanese surgeon put two and two together in the form of the Von Hacker advocated method of bringing up a portion of anterior wall of stomach through the abdominis rectus muscle (the only feature distinguishing Von Hacker's method from any other) and then making a valve as originally de-

scribed by Fontan. He obtained thereby a combined continent gastrostomy, and he published his technic and results in 1899, in a Tokyo medical journal. *To the Jap surgeon's credit, he gave credit to Von Hacker and Fontan even, in his title for his article.*

Dépage published two articles describing his gastrostomy technic—one in a Brussels surgical journal in 1901, "A New Method or Procedure for Doing a Gastrostomy"—then two years later, in 1903, followed with another article in a French Journal of surgery and titled—"Results with a New Method of Gastrostomy."

What Dépage had contributed to the procedure was that he formed a rather elongated fistulous tube from the anterior wall of stomach in such manner that the entire tube was lined with mucosa.

There were weaknesses in this planned technic as will be pointed out.

At almost the same time Janeway announced an almost identical technic, to the extent that there being some question as to who antedated who, and as priority could not be accurately determined, it was designated as the Dépage-Janeway method and was so called after that time.

Janeway brought out many technical factors of interest and gave the reasons as to why he was trying to overcome each and then how he had rationalized his technic toward such an end.

First, he was definitely of the opinion that a tube constructed from the anterior wall of the stomach was best from the standpoint both of continency and spillage over the skin, and he was aware that in a certain percentage of cases the fistula healed and had to be dilated or plastic procedures for opening it again considered.

Secondly, he was also definitely of the opinion that the tube should be constructed from the body of the stomach, not from the pyloric antrum, and that it should be placed high toward the cardia if such were feasible as in his experience leakage was more common when the procedure was attempted lower down in the stomach.

Thirdly, in carcinoma of the esophagus

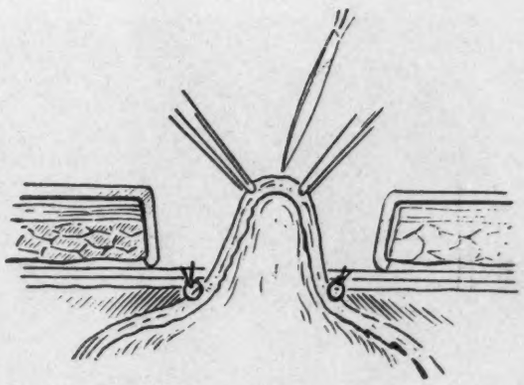


Fig. 14. An illustration from articles by various French surgeons, wherein the procedure of bringing a cone of anterior stomach wall through the rectus was utilized. (So many names are attached to this particular procedure, that the number is too great to enumerate here.)

delay in performing gastrostomy was deadly and to wait until a patient was totally dehydrated and suffering from starvation was absolutely inexcusable. His argument was: What can you offer a patient suffering from carcinoma of the esophagus other than gastrostomy? You can dilate, and this only with risk at any stage of the disease process, or you intube under equally risky circumstances, but after you do this for only a very short time the procedure is too painful for the patient or severe hemorrhage occurs to the point where patients may die while you are attempting to get past the lesion with your instrument.

Fourthly, in spite of possible leakage, skin excoriation, and closure of the gastrostomy fistula there are many advantages to the patient and this technic reduces the above disadvantage to a minimum.

It seems that to men of many nations must be given some credit for attempting to solve gastrostomy difficulties. Among these were three Russians at different times. Bassow, of Moscow, and Blondlot in the early days. One Trofimow, in 1898, suggested turning the stomach flap in such manner that the serosa formed the internal lining.

It is only fair to say here that although the published technic of Dépage and Janeway from the standpoint of priority carry

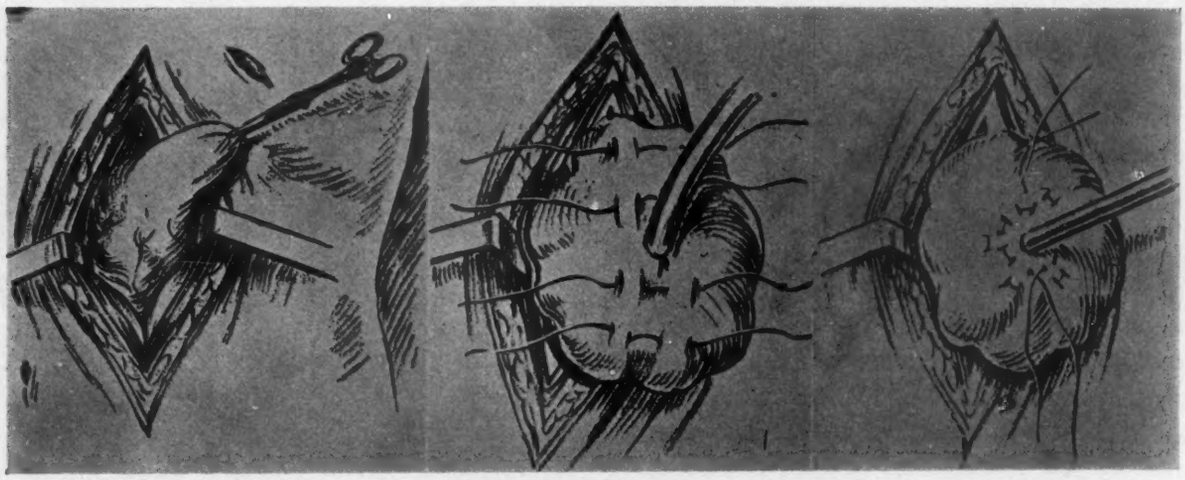


Fig. 15. Fig. 16. Fig. 17.

Fig. 15. An illustration from articles by various French surgeons, wherein the procedure of bringing a cone of anterior stomach wall through the rectus was utilized. (So many names are attached to this particular procedure, that the number is too great to enumerate here.)

Fig. 16. Gastrostomy according to Kader's method. The scene now changes to the procedure of invagination and the use of either a metal or rubber tube.

Fig. 17. Gastrostomy according to Stamm's method. The scene now changes to the procedure of invagination and the use of either a metal or rubber tube.

the following dates—Dépage, 1903 and Janeway's work did not appear until 1913, the reason for the ten-year interval and yet their joint priority credit is not satisfactorily explained.

At any rate *to recapitulate to date: Fontan originated the valve idea of the technic and Dépage originally fathered the idea of a tubular fistula. Then along came a Japaneese, Watsudjii*[17] *and combined the two procedures and published his article in 1899, and in all fairness to him should be given the credit of first combining the two procedures.*

After Dépage, there was still some dissatisfaction with the technic of the operation and we find many famous names involved in efforts toward perfection.

Senn,[8] of Chicago, added his name to the already long list by proposing in 1896, a circular valve method which was nothing new on Fontan's original idea but rather a semi-reassertion of the same idea. The thought occurs here, was this a contribution or merely the getting into print, which is easy for an illustrious name.

The extent and scope of the procedure described to accomplish a gastrostomy were and are to say the least truly amazing. In 1906, again with that title which repeats itself so often. "A New Method Of Gastrostomy" in a French Surgical Journal, one man describes how he resected about six to eight inches of jejunum, left this section attached to its mesentary, then anastomosed one end to the stomach and the other end he brought out through the skin and attached it to the skin.

Shortly after Witzel[10] announced his technic, which gave a tube lined with serosa, there came a flood of articles all more or less titled "A Modification of the Witzel Method of Gastrostomy," in which was argued the point that a catheter of smaller caliber then the one recommended by Witzel was obviously better and then, just as vehemently another article would appear arguing that a catheter of much greater caliber gave a much better result.

Amazing also is the roster of names connected in some way with gastrostomy technic because of its numbers. It would not be to any point to name all in an article such as this, but in addition to those already mentioned, Ullman, Frank,[19] Jaboulay[20] and Jianu[21] are worth retaining in memory, particularly Frank and Jaboulay because the technic advocated by these two is rather identical so that

the procedure is usually described as the Frank-Jaboulay method, thereby carrying the names of both originators.

Professor Denk, in Vienna, constantly mentioned Czerny in connection with any discussion of gastrostomy, and spoke of a Czerny method or technic. Presumably, Czerny had been Denk's master and teacher and he took the occasion to attach the name of his old professor in admiration and reverence. At any rate a search of the bibliography does not show that Czerny at any time wrote or published an article on the subject. We proceed onward through the various stages of variation in the advocated technic, through the metallic cannulas, a sort of take off on the Murphy button with a long shank or neck between the two anastomosed buttons, so that the actual fistulous tract was metallic, *if the sutures held.*

Coming up to contemporary times we find mentioned in the literature the Jianu technic and the names of men active in contemporary surgery. *Most employ the term tubo-valvular gastrostomy which is anatomically, adequately descriptive.*

In 1931, Pauchet,[22] of Paris, published an article entitled "Tubular Gastrostomy." In 1933, George Pack[23] of the Memorial Hospital in New York, published two articles relative to the Jianu technic.

Spivack's[24] *Gastrostomy is a Janeway-Dépage-Fontan operation in that Dépage contributed the tube idea many years before Spivack had appeared on the surgical scene and the same goes even more so, for the valve principle of Fontan, whom we must not let be pushed into the background and ignored because of a lack of defenders of his priority. Equally so must Watsudjii not be forgotten who was first to describe and combine two operations (Fontan and Von Hacker's) many years before Spivack, but one has only to cite the literature in chronological time and Fontan, Dépage and Watsudjii win the case.*

Thorek[25] laments the lack of appreciation of the pioneers in gastrostomy. The findings of his exhaustive study on gastrostomy are supported by Ferrari and Iturrapse,[26]

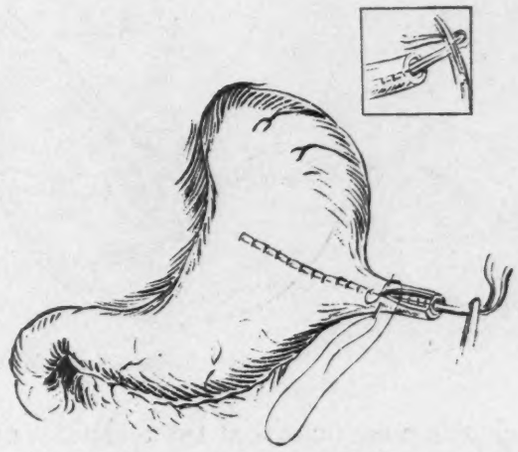


Fig. 18. Dépage's operation combing the principle of the tube and valve.

But let Thorek be comforted. The great Osler one day had an article published describing the Mickulicz syndrome in the mouth relative to Stenson's duct with the occlusion and backing up of secretion into the parotid, but Osler actually made the statement that to his knowledge the syndrome had never been described before.

To Mickulicz' credit it must be said that he did not challenge Osler's statement but others did and great must have been Osler's embarrassment to find that Mickulicz had published his experiences with the same syndrome and had described it in an article only a few years before.

To go back to the Jianu technic for a moment. Jianu's original article appeared in 1912, in the Deutsche Zeitshrift für Chirurgie. It represents in reality the results of some experimental surgery done by Beck and Carrell on dogs, here in America, at the Rockefeller Institute.

The technic of this operation has many admirable recommendations. First, is that the plastic feature on the stomach is less difficult and less prone to postoperative complications at the stomach end. Dr. George Pack of the New York Memorial Hospital, favors this operation because he is so often confronted with the problem of a plastic rebuilding of a lower end of esophagus after resection for carcinoma and it lends itself best to such a purpose.

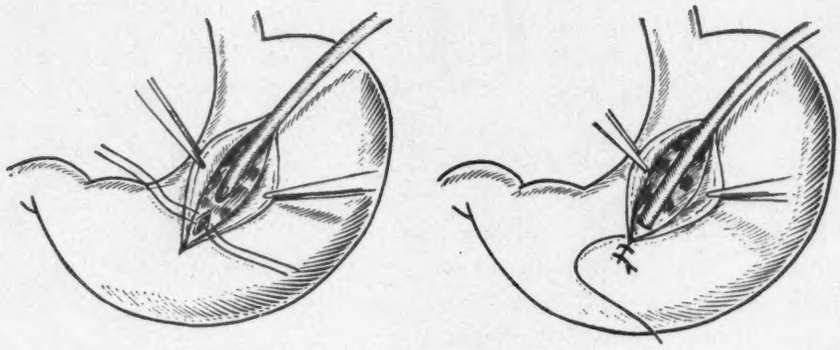


FIG. 19. Technic and procedure of Marwedel.

Pack also points out that the technic is not difficult and the hazard to the patient, always a poignant factor in Pack's mind, is definitely less.

This is a somewhat similar technic. At least the principles are the same as the plastic reconstruction of a cut ureter where the amount available for implantation into the bladder is short.

Pack stresses some important points in the technic conducive to success: (1) The lumen of the tube should be 1 inch or more in diameter. (2) Tension on the tube by the pulling of a weighted stomach after food intake requires anchoring the stomach to the abdominal wall as securely as possible.

A gastrostomy contemplated as a permanent fixture or addition to the human economy should fulfill certain objectives fully and completely. These objectives are relatively obvious and go almost without saying, yet it was the striving for perfection in one or more of them that led to the final technics which we know today: (1) There should be no leakage from the stoma, thereby, avoiding excoriation of skin; therefore, some type of closure mechanism, a sphincter or a valve, is necessary to prevent this excoriation. (2) The lining walls of a gastrostomy should be of such tissue as will not become adherent, thereby causing closure of the fistula necessitating either bouginage and dilation or a secondary operation. (3) Clinical experience has determined that the gastric end of the tube functions better the farther away from the pylorus it can be made. (4) The canal should be as long as possible so that a feeding tube can be inserted for some distance. (5) The canal should bend (a bit of tortuosity is desirous) as it prevents regurgitation.

Fluids may be taken by mouth concomitantly with a gastrostomy, thereby giving the patient some degree of retention of taste-swallowing and the agreeable presence of something in the mouth. As in peptic ulcer—or analogous to the situation in ulcer—any degree of by-passing leads to a marked diminution of edema and inflammation about the lesion so that a patient finds himself able to swallow soft solids with greater ease, thereby opening up to him a new vista of food possibilities and from a psychotherapeutic angle the patient is happier even if this phase may be only temporary.

Although the Witzel method worked well in a jejunostomy or ileostomy, it does not work as well when applied to the stomach.

Marwedel's method differed from Witzel's only in that the first step is a puncture wound in the anterior wall of the stomach and inserting a rubber catheter therein, then holding it in place by means of a purse-strung suture; next making an incision in the seromuscular layer, laying the catheter along in this incision track and suturing the opposite cut edges of this seromuscular layer over the catheter in such manner as to construct a fistulous canal.

The technical method advocated by Senn, differed only that several purse-string sutures were placed, each a little wider and larger than the previous one, so

that on drawing each together a deeper invagination was obtained.

It is difficult to award much credit to either Marwedel or Senn, particularly as to any originality in their modifications of Witzel's procedure.

Using a portion of jejunum or colon to manufacture a tube is extremely difficult technically and carries with such a procedure an extremely high mortality from infection.

Dépage, in 1901, published an article outlining the following technic. He cut out a rectangular flap of stomach wall through all layers—leaving the base parallel to the lesser curvature of the stomach and not cut or sectioned. Rolling and suturing the cut edges of this flap to form a tube, then attaching the distal end to the skin, completed the operation.

Modernizing this technic as of today presents some advantages.

It can be done under novocaine anesthesia. The anterior wall of the stomach can be delivered through a relatively small abdominal incision in such manner that the operation can be done entirely outside of the abdomen.

Janeway merely turned the operation around—so that the base paralleled the greater curvature instead of the lesser and thus was born another "New Method of Gastrostomy."

In a search through the bibliography of gastrostomy, one finds twenty-six articles on the procedure—all titled: "*A New Method of Gastrostomy*." Janeway believed he had to put forth some claim as to the superiority of his operation over Dépage's, so he claimed that his suture line being on the upper surface of the newly made canal was less subject to strain and that his technic gave a better blood supply as it was derived from the greater curvature of the stomach, whereas, Dépage's was from the lesser.

The Jianu technic can best be described by a diagram.

The advantages of this method as practiced and described by Dr. George Pack

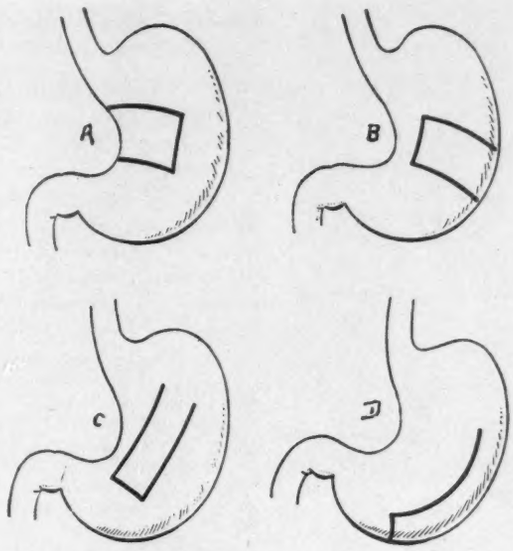
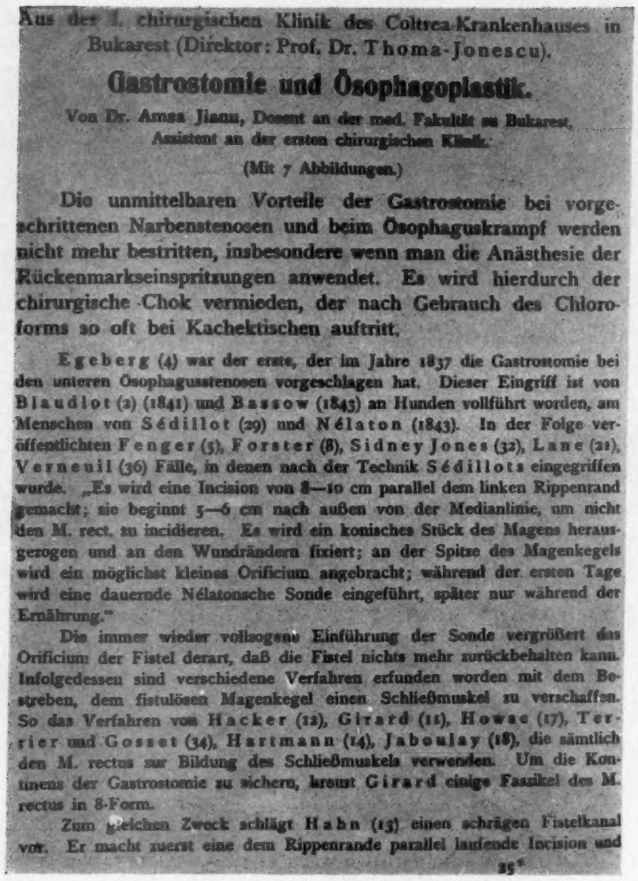


Fig. 20. Illustrating how several authors by adapting a different area for the same procedure but with little variation in technic manage to attach their names to the procedure of gastrostomy: A, Dépage's method; B, Janeway's method; C, Hirsch's method; D, Jianu's method.

are: (1) The external end is brought out to the skin so high that the possibility of regurgitation is markedly limited. (2) Subcutaneously it burrows under the superficial tissues and rectus muscle in such a manner as to take advantage of whatever voluntary compression there may be and the rectus may act as a sphincter. (3) Bending the tube upward accomplishes the function of a valve. (4) The lumen resulting is often of sufficient caliber to allow administration of semi-solid food.

Dr. Carl Beck[27] with Alexis Carrell developed a gastrostomy wherein a tube was made from the greater curvature of the stomach. The work was entirely experimental—done on dogs—but was presented before the Chicago Medical Society. Beck and Carrell should have more credit even than Jianu for originating this procedure but the operation was described as a prethoracic esophagus and the article remained hidden for years because published under such a title.

Dépage had advocated the same technic as Jianu or Beck-Carrell in cases of urinary retention, namely, the making of a fistula



Aus der I. chirurgischen Klinik des Coltrea-Krankenhauses in Bukarest (Direktor: Prof. Dr. Thoma-Jonescu).

Gastrostomie und Ösophagoplastik.

Von Dr. Amza Jianu, Dozent an der med. Fakultät zu Bukarest, Assistent an der ersten chirurgischen Klinik.

(Mit 7 Abbildungen.)

Die unmittelbaren Vorteile der Gastrostomie bei vorgeschrittenen Narbenstenosen und beim Ösophaguskrampf werden nicht mehr bestritten, insbesondere wenn man die Anästhesie der Rückenmarkseinspritzungen anwendet. Es wird hierdurch der chirurgische Chok vermieden, der nach Gebrauch des Chloroforms so oft bei Kachektischen auftritt.

Egeberg (4) war der erste, der im Jahre 1837 die Gastrostomie bei den unteren Ösophagusstenosen vorgeschlagen hat. Dieser Eingriff ist von Blaudlot (2) (1841) und Bassow (1843) an Hunden vollführt worden, am Menschen von Sédillot (29) und Nélaton (1843). In der Folge veröffentlichten Fenger (5), Forster (8), Sidney Jones (32), Lane (21), Verneuil (36) Fälle, in denen nach der Technik Sédillots eingegriffen wurde. „Es wird eine Incision von 8—10 cm parallel dem linken Rippenrand gemacht; sie beginnt 5—6 cm nach außen von der Medianlinie, um nicht den M. rect. zu incidieren. Es wird ein konisches Stück des Magens herausgezogen und an den Wundrändern fixiert; an der Spitze des Magenkegels wird ein möglichst kleines Orificium angebracht; während der ersten Tage wird eine dauernde Nélatonsche Sonde eingeführt, später nur während der Ernährung."

Die immer wieder vollzogene Einführung der Sonde vergrößert das Orificium der Fistel derart, daß die Fistel nichts mehr zurückbehalten kann. Infolgedessen sind verschiedene Verfahren erfunden worden mit dem Bestreben, dem fistulösen Magenkegel einen Schließmuskel zu verschaffen. So das Verfahren von Hacker (12), Girard (11), Howse (17), Terrier und Gosset (34), Hartmann (14), Jaboulay (18), die sämtlich den M. rectus zur Bildung des Schließmuskels verwenden. Um die Kontinenz der Gastrostomie zu sichern, kreuzt Girard einige Faszikel des M. rectus in 8-Form.

Zum gleichen Zweck schlägt Hahn (13) einen schrägen Fistelkanal vor. Er macht zuerst eine dem Rippenrande parallel laufende Incision und

35*

FIG. 21. Facsimile of title page of Jianu's original article advocating his procedure.

from the urinary bladder out to the abdominal wall.

From the standpoint of overcoming leakage Senn's operation was a great improvement. Sometimes he sutured the base of his cone to the parietal peritoneum to overcome the pulling action of the stomach.

SUMMARY

Among the writing craft there exists a motto: "If you steal from one author, it is plagiarism; if you steal from many, it is research."

In the realm of psychology probably lies the explanation of a type of conduct one finds so consistently present in the evolution of some particular surgical technic. So consistently and even persistently does one find it that it cannot by any chance be attributed to mere coincidence.

To the non-psychologist, but one having some experience in the detached scrutiny of the ways of human conduct there is only one explanation. A terrifically frustrated ego exists which drives eternally for expression, for a labeling or attachment of self by way of name to something—in medical and surgical parlance—some step in treatment or procedure in surgical technic, that the individual hopes may go down into posterity, thereby perhaps justifying one's having passed through this cosmos called world. This seems to be a part of the makeup of so many men in the field of medicine.

How else can one explain the making of an incision a half inch or so to this side or that side and calling it a "new method"; or reversing a suture line, starting at the top or vice versa at the bottom, or the accidental happening upon some procedure, which some less fortunate colleague used years before, and then rushing into

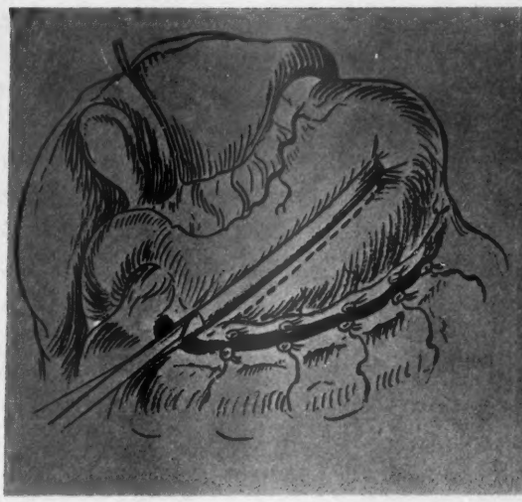


Fig. 22. Illustrating a step in the technic of the Jianu gastrostomy.

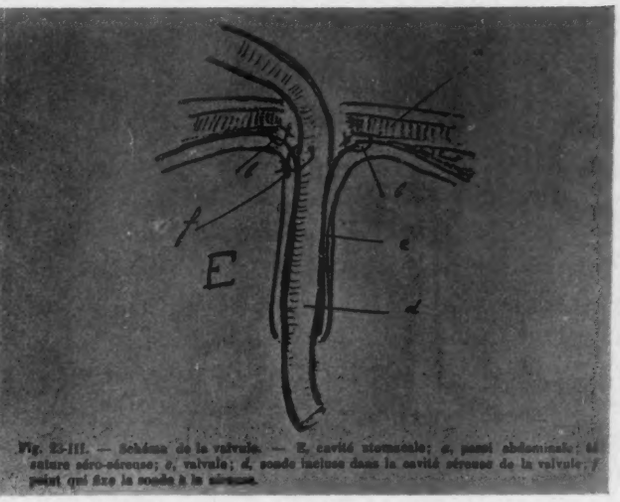


Fig. 23. Illustrating the technic of one of the earliest French surgeons to use a tube.

print with a grand flourish, "*a new method.*"

One sees this type of thing so much in a search or study of the medical literature of the past that one becomes stonily cynical and rather hard boiled in approach to anything labeled "*a new.*" However, as a matter of historical accuracy it behooves some of us to scan with a degree of honesty, yet critically current contemporary claims to priority in these so-called "new methods" of doing this or that.

Medical achievement has been gradual and step by step. This is as it should be. One person here makes an observation and records it. Fortunate indeed that it should be this way. In another place some one tries it, and possibly finds it wanting and strives to improve upon it, adding a little something. Somebody else points out some deficiencies and tries to solve them. Thus by an evolution of ideas final perfection may be reached or approached. Medical historians in later years scan these contributions and give priority where it is due because there exists material evidence and corroboration in the printed word—in the original publications—in which the ideas were set forth for the use of the medical world at large.

This is particularly well illustrated in the historical evolution of the procedure of gastrostomy. We know and have proof, documented proof, that a military surgeon named Egeberg, in statements before a medical society in Christiania made the following remarks: "I cannot see why the indications should not be just as great to open the intestinal canal to put nourishment in as to open it to take a foreign body out."

We surmise that Egeberg may have been influenced by reading of the experiences of another military surgeon, Wm. Beaumont with "old fistulous Alexis," illustrating to him that a man could live in health with a permanent opening in his stomach. We surmise this because we are aware that Dr. Beaumont's experience was much publicized in Europe and in addition because there exists a certain co-incidence as to dates and time.

From here on we find that process of evolutionary step by step improvement upon the original. A French surgeon, Sédillot in 1846, lifts a cone-shaped segment of the anterior wall of the stomach through an abdominal incision and behold you have the first completed operation of gastrostomy. But for reasons mentioned in the body of this article the patients died. Therefore, although the idea is a good one it must be made to work better.

Along in 1888, in 1890 and in 1893, three men, Girard, Von Hacker and Jaboulay proposed that instead of bringing the cone

of stomach wall directly to the skin through the abdominal wall, it should be brought through the subcutaneous tissues in such manner that the rectus abdominis muscle shall act in a sphincteric manner as to stop leakage around the attachment.

Although this was a minor improvement it did not solve the problem of spillage, skin excoriation, etcetra. So we find more names attached to contributions, one Sabanieff, one Hartmann, and a Frank, in the years from 1890 to 1893. These suggested various and sundry complicated passages of a *cone* or *anterior gastric wall* through and between the subcutaneous tissues and muscles. One suggested bringing the cone through the skin between the costal cartilages hoping to utilize the latter for sphincteric action. It is important to realize and emphasize that these men all were using a cone of tissue in view of what is coming later.

In 1894 and 1902, two men suggested twisting this cone of tissue so that when fastened to the abdominal wall, the torsion of the tissues would obstruct leakage and spillage. These men were Ullmann and Souligoux.[28]

We return to France and *the French school of surgery for the first milestone in evolution of the operation, and give credit where credit is due.* In 1893, Pénières proposed constructing a valve from gastric mucosa to combat leakage, and proceeded to perform the operation on dogs in his laboratory in Toulouse; whereupon another Frenchman, Fontan, not, however, without giving due credit to his countryman, proceeds to perform the operation on humans, differing in technic from his confrére in that he made his valve using all the layers of stomach wall instead of mucosa alone as did Pénières.

The operation now consisted of a canal instead of a cone with a valve arrangement to prevent leakage. That was the operation as proposed by Fontan and Pénières, a completed operation, the principles originated and laid down by them and the basis upon which any subsequent minor changes were laid. *To these men should go the credit for the development of the procedure.* The operation to many was still one which could be improved upon.

Here again crops up that curious conduct on the part of the surgical mind. Where one man would propose placing a catheter through a stab wound into the stomach, then plicating the serosa over it by means of one or two purse-string sutures, one would rush into print with "a new method." The "new" consisted of placing first the stab wound a half inch or so higher or lower than the first proposer or instead of one or two layers of purse-string sutures advocating three or four, as providing greater strength to the finished canal, therefore, greater safety.

Then along came the men who courageously departed a bit farther and who may have been honest and upright in their thinking and advocacy of their ideas. These were the men who advocated the substitution of other hollow viscera as tubes between the stomach and skin. Such was the isolated pedicled loop of jejunum as advocated by Roux and Lexer and the isolated segment or pedicled loop of transverse colon advocated by Vuillet in 1911, and Kelling in the same year.

Somehow one gets an impression that Roux must have been in his seventh heaven playing with loops of intestines, attaching here and there, the more complicated, the more enthusiastic and delighted he was, much as a child with an erector set, but he used gut, instead of blocks or metal. It is a laborious piece of work to read of the different anastamoses he made and proposed.

Then along came the men who proposed the construction of tubed pedicled flaps from the stomach wall. Most prominent of these were Dépage and Janeway and both names were used connectedly to describe a technic and procedure *originated by Dépage in* 1901; but the story goes that Janeway was using and had originated a similar operation, entirely unaware of Dépage's work, so somewhere the idea got

abroad that he should be given credit with Dépage and the operation has since been spoken of as the Dépage-Janeway technic. It is curious that Dépage's article describing his procedure appeared in 1901, and Janeway's in 1913, a considerable discrepancy in time.

Here again that curious pattern of conduct: Dépage made his tubed flap with the base at the lesser curvature. Janeway made his with the base at the greater curvature, and insisted that his was the better method because it had a better blood supply, at any rate it was a "new method." Watsudjii combined Von Hacker's and Fontan's operations giving them credit while Spivack combined Fontan's and Dépage's operations and described it an "original"—"new method" without allocating proper credits.

Then came the tubed flap made by partial severance of the greater curvature of the stomach with the base at cardia and another with base at the fundus. These were: (1) the operation worked out in the laboratory by Alexis Carrell with Beck and called the Carrell-Beck procedure, and (2) the method of Jianu used successfully by Dr. George Pack.

It is quite possible that a more detailed and thorough perusal of available literature on the subject of gastrostomy might have brought to light even more material than is quoted here.[29,30] However, over fifty different technics or plans of operation have been published by various authors and the predominent part of these had "A New Method" as part of their title.

However, in the past thirty-five years nothing new has been added to our technical knowledge concerning gastrostomy and *no surgeon of recent times, or contemporary to the day is warranted lifting the work of the men who actually made the contribution and applying his own name to it. Sufficient documentary proof exists in published articles with names and dates to make any such conduct too easy to refute and make a lie.*

CONCLUSIONS

1. A thorough survey of the available literature on gastrostomy has been made and the following conclusions have been reached:

2. *Credit for conceiving the first gastrostomy, unreservedly belongs to Egeberg* (1837). *To Sédillot irrevocably belongs the credit for having performed the operation successfully* (1846).

3. *Credit for perfecting a watertight, continent and leak-proof valve from all layers of the stomach must be accorded to Fontan* (1896).

4. *For first developing a mucous lined tube from the entire thickness of the stomach, the credit belongs to Dépage, a Belgian surgeon* (1901).

5. *In order to perfect gastrostomy, the combination of two operations (Von Hacker's and Fontan's), was first done by Watsudjii in* 1899.

6. *A painstaking survey of the literature discloses that all other so-called "new methods" including Spivack's et al. are based on the work of the pioneers long passed.*

REFERENCES

1. Egeberg, Chr. A. *Christiana med. Gessellsch.* Om Behandlingen Af Impenetrable Strictura i Madroret. *Norsk mag. f. laegevidensk.*, 2: 97, 1841.
2. Sédillot, M. C. Observation de Gastrostomie. *Gaz. d. hop.*, 26: 160–161, 1853. De la Gastrostomie Fistuleuse. *Acad. de Sc.*, p. 222, 1846.
3. Fenger, E. Veber Anlegung einer Kunstlichen Magenoffnung am Menschen durch Gastrostomie. *Arch. f. path. Anat. u. Physiol.*, 6: 350–384, 1854.
4. Fontan. Une nouvelle operation de gastrostomie. (Procédé Valvulaire.) *Franc. de Chir.-Proc. Verb. Paris*, 10: 411–415, 1896.
5. Pénières, L. De la gastrostomie par la méthode de la valvule ou de plissement de la mugueuse stomachale. *Arch. Prov. de Chir., Paris*, 2: 284, 1893.
6. M. Petit de la Villeon. *Bull. et mém. Soc. de chir. de Paris*, vol. 32, March 6, 1931.
7. Andrews, E. and Andrews, E. Wyllis. A new method of valvular gastrostomy with a mucous membrane lining. *J. A. M. A.*, 22: 734–737, 1894.
8. Verneuil. Observation de gastrostomie practiqué avec succès pour un retrecissement cicatriciel infranchissable de l'oesophage. *Bull. Acad. de méd.*, 5: 1023–1038, 1876.
9. von Hacker, V. Veber die Verwenoung des Musculus Rectus Abdominis 3vm Verschlusse

der Kunstlichen Magenfistel." *Wien. med. Wchnschr.*, 36: 1073–1078, 1886, 1110–1114, 1886.

10. Witzel, O. Zur Technik der Magenfistelanlegung. *Zentralbl. f. Chir.*, 18: 601–604, 1894.
11. Stamm, M. Gastrostomy by a new method. *Med. News*, 65: 324–326, 1894.
12. Kader, B. Zur Technik der Gastrostomie. *Zentralbl. f. Chir.*, 23: 665–670, 1896.
13. Marwedel, G. Zur Technik der Gastrostomie mit Krankenuozstellvig. *Beitr. z. klin. Chir.*, 17: 56, 1896.
14. Dépage, A. Nouveau procédé pour la gastrostomie. *J. de chir. et ann. Soc. belge de chir.*, 1: 715–718, 1901.
15. Dépage, A. Resultants d'une nouvelle méthode de gastrostomie. *Ass. Franc. de chir. de Paris*, 16: 332, 1903.
16. Janeway, Henry H. Eine neue Gastrostomie methode. *München. med. Wchnschr.*, 60: 1705, 1913. The relation of gastrostomy to inoperable carcinoma of the esophagus. *J. A. M. A.*, 61: 93, 1913.
17. Watsudjii, H. Eine Combinierte Anwendung des Hackers und Fontanschen Verfahrens bei der Gastrostomie. *Mitt. de med. Gesellsch. zu, Tokyo*, 13: 879, 1899.
18. Senn, Emmanuel J. Gastrostomy by a circular valve method. *J. A. M. A.*, 27: 1142, 1896.
19. Frank, R. Eine neue Methode der Gastrostomie bei Carcinoma Oesophagi. *Wien. klin. Wchnschr.*, 6: 231, 1893.
20. Jaboulay, M. Procédé pour pratiquer la gastrostomie et la cystostomie. *Gaz. hebd. de méd. et de chir.*, p. 89, 1894.
21. Jianu, Amaza. Gastrostomie und Oesophagoplastik. *Deutsche Ztschr. f. Chir.*, 118: 383, 1912.
22. Pauchet, V. Gastrostomie tubulaire continente. (Procédé de Depage.) *Bull. et mém. Soc. de chir. de Paris*, 23: 158, 1931.
23. Pack, G. T. The Jianu gastrostomy. *Surg., Gynec. & Obst.*, 57: 86, 1933. Beck-Jianu gastrostomy. *Surg., Gynec. & Obst.*, 57: 810, 1933.
24. Spivack, J. L. Eine neue Methode der Gastrostomie. *Bruns' Beitr. z. klin. Chir.*, 147: 308, 1929. Utilization of the posterior wall of the stomach in valvulotubular gastrostomy in case of small and contracted stomach. *Clin. Med. & Surg.*, 40: 212, 1933. Técnica quirúrgica en las operationes abdominales. U.T.E.H.A. Edit., Mexico, 1937.
25. Thorek, Max. Tubovalvular gastrostomy: history and technique. *J. Michigan State M. Soc.*, vol. 44, No. 2, Feb., 1945. Modern Surgical Technique. (War Edition.) Philadelphia, 1942. J. B. Lippincott Co. Surgical Errors and Safeguards. 4th ed. Philadelphia, 1943. J. B. Lippincott Co. Técnica quirúrgica moderna. Tomo 3: 61, Edit. Salvat, Barcelona, 1941. The history and development of gastrostomy. *J. Internat. Coll. Surg.*, 6: 295, 1943.
26. Ferrari, Roberto C. and Iturrapse, Miguel Correa. La gastrostomia. *Bol. Inst. Clin. Quir., Buenos Aires*, 19: 631–681, Dec., 1943.
27. Beck, C. and Carrel, A. Demonstration of specimens illustrating a method of formation of a prethoracic esophagus. *Illinois M. J.*, 7: 463, 1905.
28. Souligoux, Ch. Gastrostomie par torsion. *Bull et mém. Soc. de chir. de Paris*, 37: 818, 1911. Souligoux, Ch., et Bloch, R. La gastrostomie continente. Procédé de Ch. Souligoux. *Presse méd.*, 28: 857, 1920.
29. Schnitzler, J. Zur Technik der Gastrostomie. *Wien. klin. Rundschau.*, 10: 513–514, 1896.
30. Carabba, V. Gastrostomy: clamp method. *Am. J. Surg.*, 27: 484, 1935.

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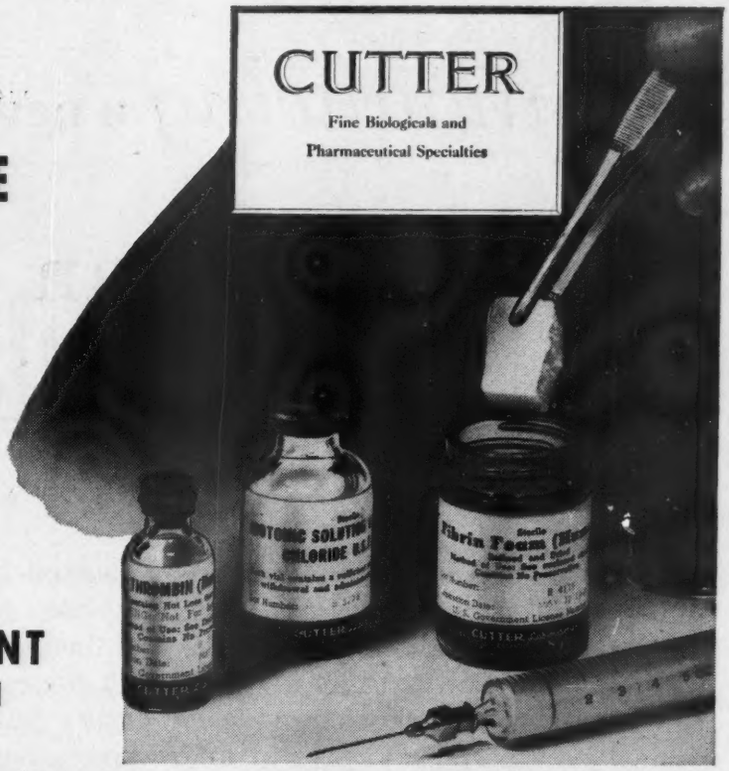
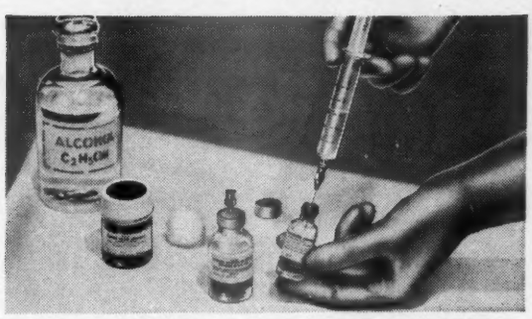
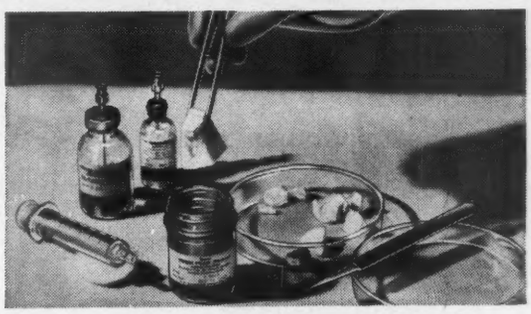




1. Fibrin Foam and Thrombin come in 3 vials—the foam, dried thrombin, and isotonic sodium chloride. Dissolve sterile thrombin by adding 3 to 4 cc. physiological saline. Transfer Fibrin Foam to aseptic container, use wide-mouthed sterile bottle for dilution of thrombin solution.



3. Moisten Fibrin Foam in thrombin solution just before applying to freshly sponged bleeding area. Apply gentle pressure for a moment until clot forms; then leave in place to be absorbed. Made from proteins of pooled normal blood plasma, it is homologous, non-reactive.

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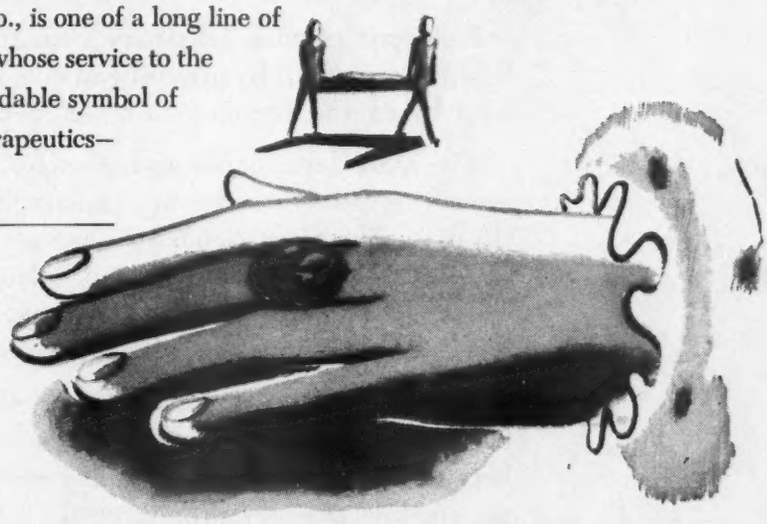

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Unsupervised dietary curtailment and self-imposed food restrictions, not infrequently observed in elderly patients and in those desirous of preventing weight gain or losing weight, are apt to lead to multiple nutritional derangements. Not the least important among these, and often overlooked, is protein deficiency.

The early symptoms of chronic protein deficiency are vague and lack specificity. Thus they escape detection unless pointedly looked for. Easy fatigability, loss of weight, anorexia, malaise, and a slight pallor due to underlying secondary anemia constitute the most common complaints. A careful history of eating habits usually discloses the true significance of these symptoms.

Detection of the earliest objective sign of protein deficiency—negative nitrogen balance—requires hospitalization for several days, in order that nitrogen intake and excretion can be accurately determined.

Prolonged protein deficiency leads to hypoproteinemia, and is readily recognized by generalized edema and by a serum protein level below the normal 7 to 8 Gm. per 100 cc.

The most dependable and effective means of preventing and correcting protein deficiency is through proper organization of the diet. The recommended intake of 1 Gm. of protein per Kg. of body weight insures nitrogen balance in normal persons. For correction of frank protein deficiency, at least 2 Gm. per Kg. of body weight—and frequently considerably more—is required.

Among the protein foods of man, meat ranks high, not only because of the generous supply of protein it provides, but also because its protein is biologically complete, applicable for the satisfaction of every protein need.

The Seal of Acceptance denotes that the nutritional statements made in this advertisement are acceptable to the Council on Foods and Nutrition of the American Medical Association.

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AMERICAN MEAT INSTITUTE

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4:11 ALARM

Preoperative nervousness is multiplied by a sleepless night. Realizing this, many careful surgeons routinely prescribe Nembutal, 1½ grs., the evening before, in addition to the one or two 1½-gr. capsules commonly ordered about an hour before surgery. These men know that the patient prepared in this way arrives in the operating room with fear and nervousness largely allayed, permitting smoother induction of anesthesia and quieter operating procedure. They know the marked *clinical safety* of Nembutal, a feature due partly to the brief action of the drug, which permits rapid recovery, and partly to a dosage only about one-half that of most barbiturates, which greatly reduces the amount of drug to be eliminated. Do you and your surgical patients now enjoy these advantages? If not, your prescription or hospital pharmacy will be happy to cooperate in making them available . . . TODAY.

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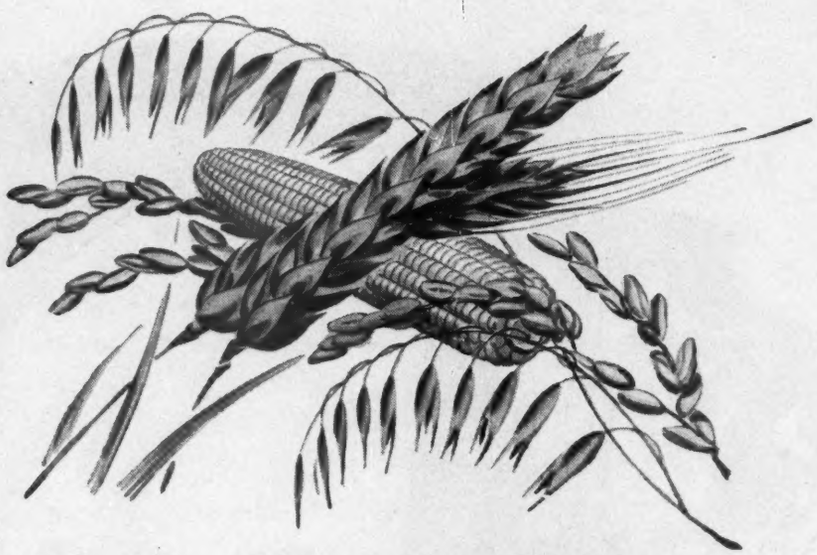

As the Patient Returns to Normal Activity

Carefully supervised postoperative feeding in many instances achieves a state of nutrition which frequently is the best attained by the patient in years. As the postsurgical period of convalescence terminates and normal physical activity again becomes possible, specific dietary recommendations may well be made with a view toward maintaining the gains thus established.

In the prescribed dietary, emphasis upon the importance of breakfast appears justified in view of the fact that this meal is the one most frequently neglected. Yet a good nutritional status can hardly be maintained if the day is begun with a nutritionally inadequate meal. Nutrition authorities universally recommend a basic breakfast pattern of fruit, cereal with milk, bread or toast and butter, and beverage. The presence of the cereal serving in this pattern adds substantially to the nutritional values of this meal, contributing biologically adequate protein, quickly available food energy, B complex vitamins, and important minerals. The quantitative contribution made by the dish consisting of 1 ounce of cereal (whole grain, enriched, or restored to whole grain values of thiamine, niacin, and iron), 4 ounces of milk, and 1 teaspoonful of sugar is apparent from this table of composite averages:

Calories	202
Protein	7.1 Gm.
Fat	5.0 Gm.
Carbohydrate	33 Gm.
Calcium	156 mg.
Phosphorus	206 mg.
Iron	1.6 mg.
Thiamine	0.17 mg.
Riboflavin	0.24 mg.
Niacin	1.4 mg.

The presence of this seal indicates that all nutritional statements in this advertisement have been found acceptable by the Council on Foods and Nutrition of the American Medical Association.

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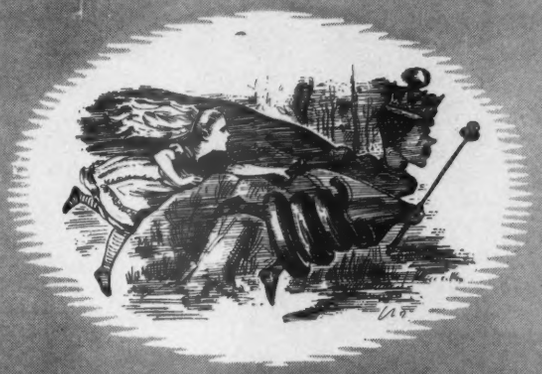

Alice had it easy

We've come to appreciate Alice's feelings in "Through the Looking Glass" when the Red Queen said,

"... it takes all the running you can do, to keep in the same place. If you want to get somewhere else, you must run at least twice as fast as that!"

But we find ourselves in an even more trying predicament.

Production of AMINOIDS* is up more than 100% over last year and still we are not able to keep up with the demand.

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Heptuna combats the entire anemia syndrome. It supplies not only ferrous sulfate, the most readily available form of iron for hemoglobin synthesis, but also seven essential vitamins, and the B-complex factors of liver and yeast.

Heptuna thus enhances absorption and utilization of iron, stimulates hemoglobin regeneration, and effectively combats many of the systemic disturbances encountered in hypochromic anemia.

EACH CAPSULE CONTAINS:

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Vitamin A (Fish-Liver Oil)	5,000 U.S.P. Units
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Vitamin B_2 (Riboflavin)	2 mg.
Vitamin B_6 (Pyridoxine Hydrochloride)	0.1 mg.
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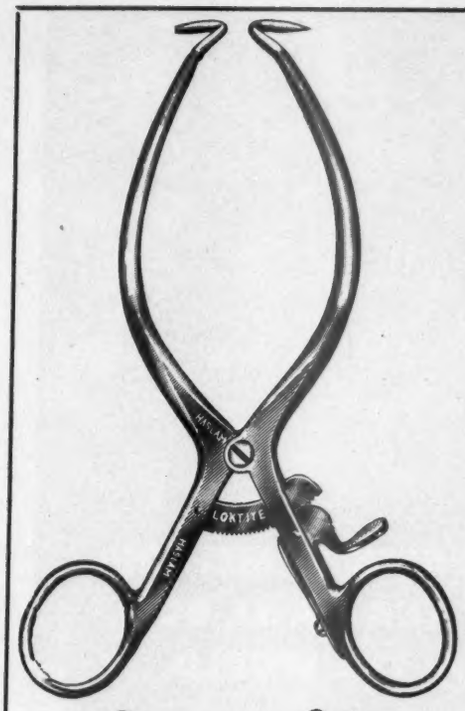

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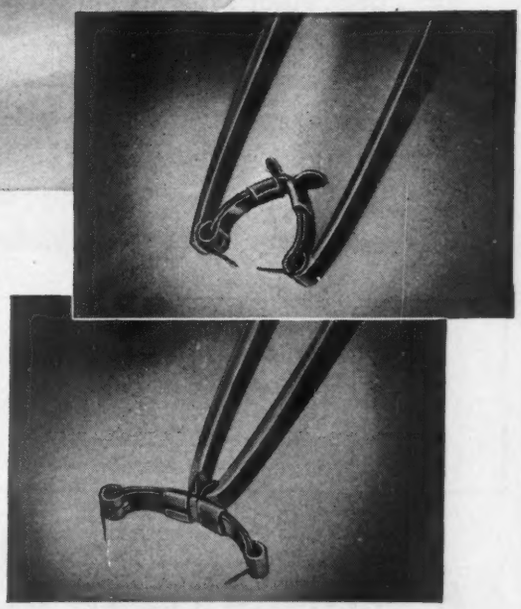

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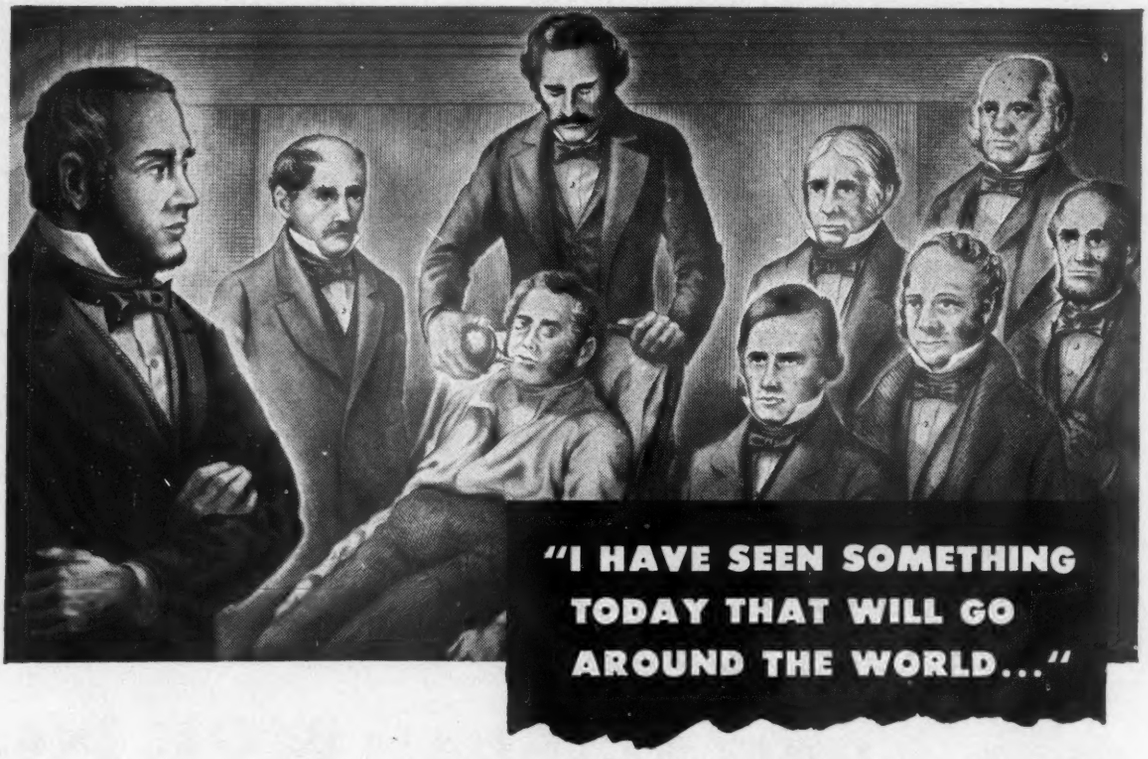

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1. Davison, F. R.: Synopsis of Materia Medica, Toxicology, and Pharmacology, 3rd ed., St. Louis, Mosby, 1944.

2. MacIntosh, R. R., and Pratt-Bannister, F. B.: Essentials of General Anaesthesia, 3rd ed., New York, Oxford University Press, 1943.

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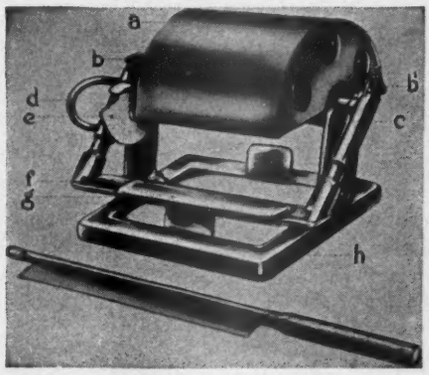

By means of this unique instrument a sheet of skin of uniform thickness may be cut at any predetermined level the size of the drum (4 x 8 inches) from any area of the body. Those who have used the dermatome state that it simplifies the technique and enlarges considerably the whole field of skin grafting. Same blade used for drum may be placed in handle and used to cut razor grafts or for honing blade. Rubber cement for the drum and donor area also is available, as well as a knife sharpening service.

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Aminonat

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ANEMIA

Iron-deficiency anemia is a factor to be considered in pre and postoperative conditions. Hence, we suggest that you prescribe Copperin routinely for a period preceding and following surgery. Copperin stimulates the hematopoietic system—provides material for replacement of hemoglobin—increases the red blood cell count.

Because in Copperin iron ammonium citrate is combined with the catalyst copper sulphate, there is a greater utilization of the iron by the system. For this reason the iron content per capsule is purposely small—32 Mgm. As there is no stomach irritation or constipating effect from Copperin, it is exceptionally well adapted to routine use. In two strengths: Copperin "A" for adults; Copperin "B" for children.

Liberal professional samples gladly sent on request

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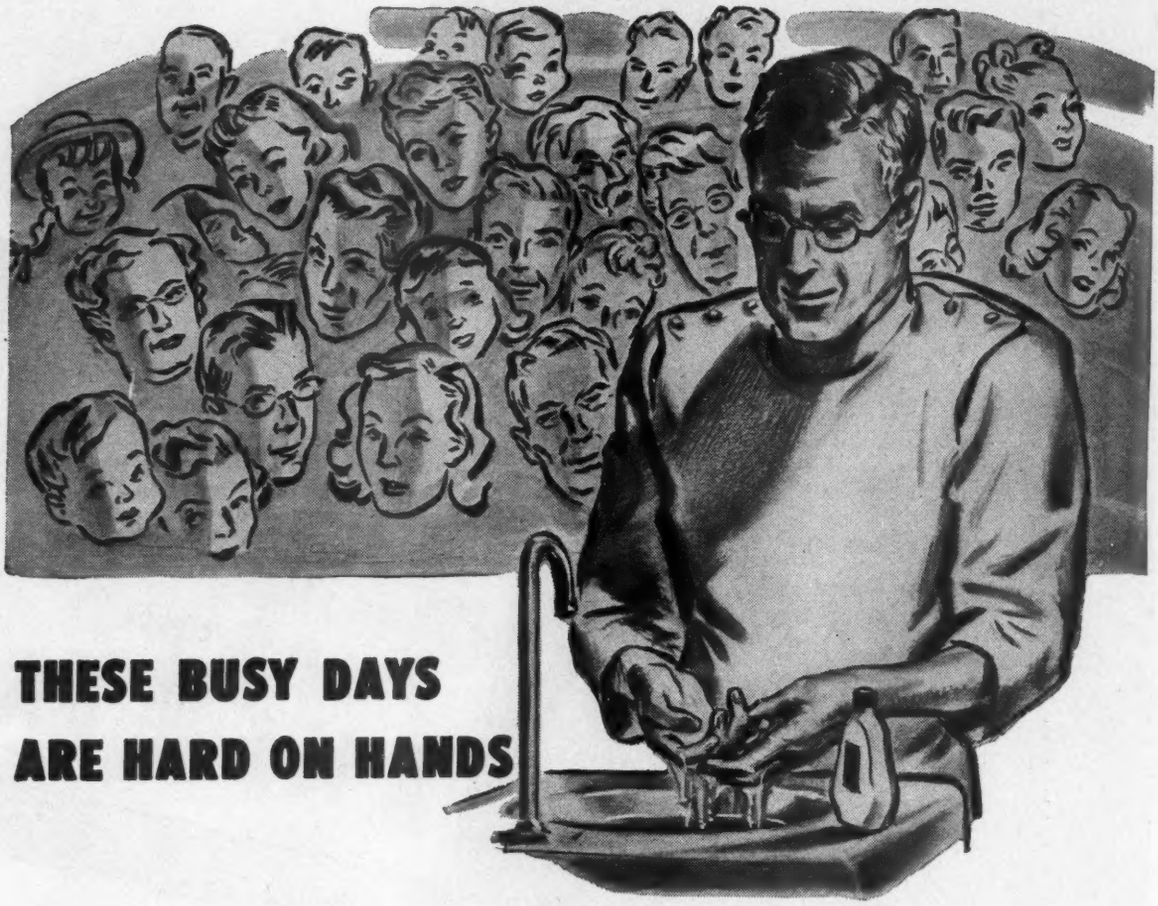


THESE BUSY DAYS ARE HARD ON HANDS

Are YOURS *receiving proper care Doctor?*

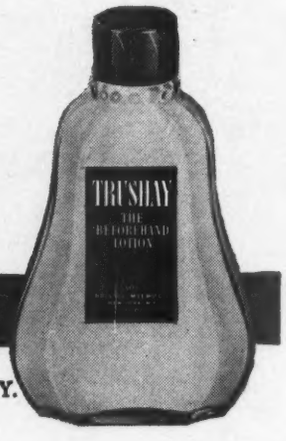
Frequent cleansing with soap and water is often hard on skilled and sensitive hands. Also preoperative "scrubbing up" with hot running water, green soap and alcohol rob the skin of its natural lubricant.

TRUSHAY is widely used by professional men and women as an aid in replacing natural oils and to help keep dermal tissue normal and unbroken.

Smoothed on just before washing, TRUSHAY is just what is needed to help protect skilled, sensitive hands and keep them soft, smooth and supple. TRUSHAY is well adapted to the needs of the physician, the nurse and the technician.

TRUSHAY

THE "BEFOREHAND" LOTION



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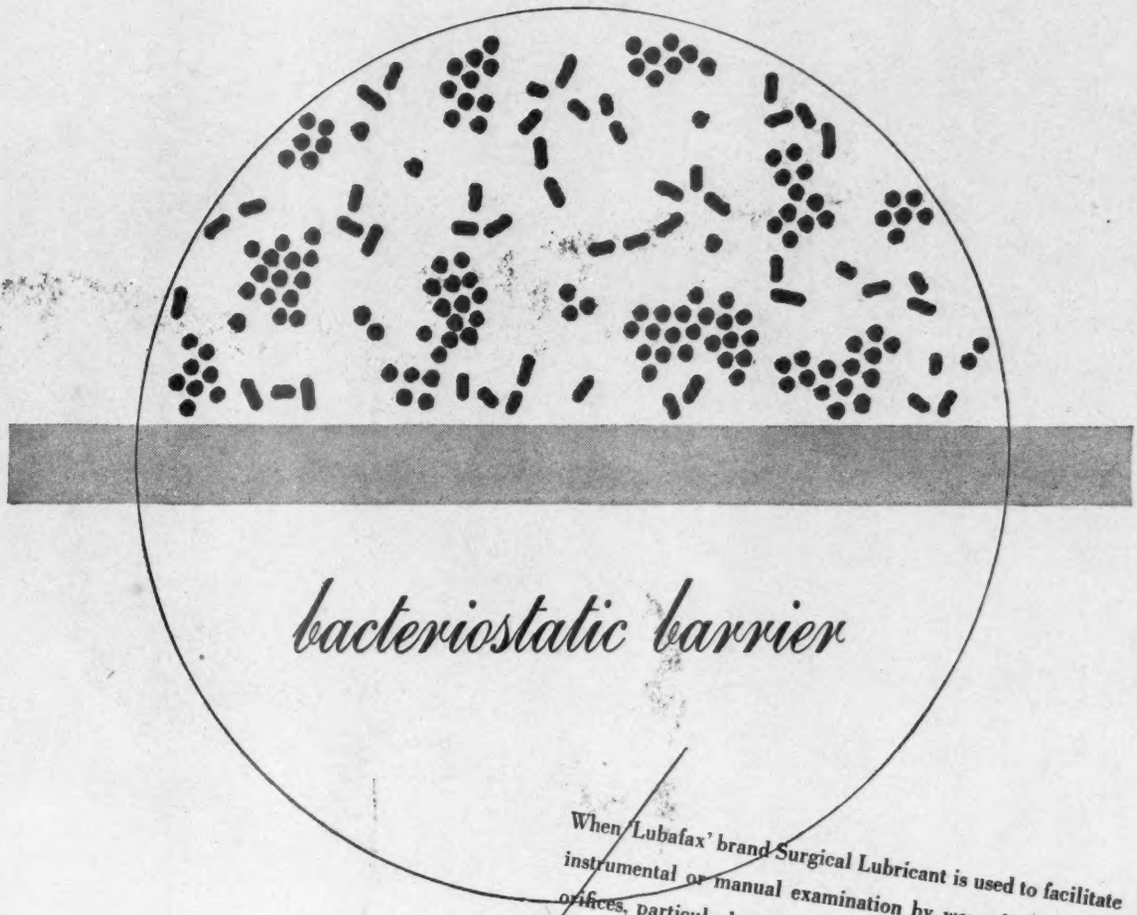

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'LUBAFAX' BRAND *surgical lubricant*

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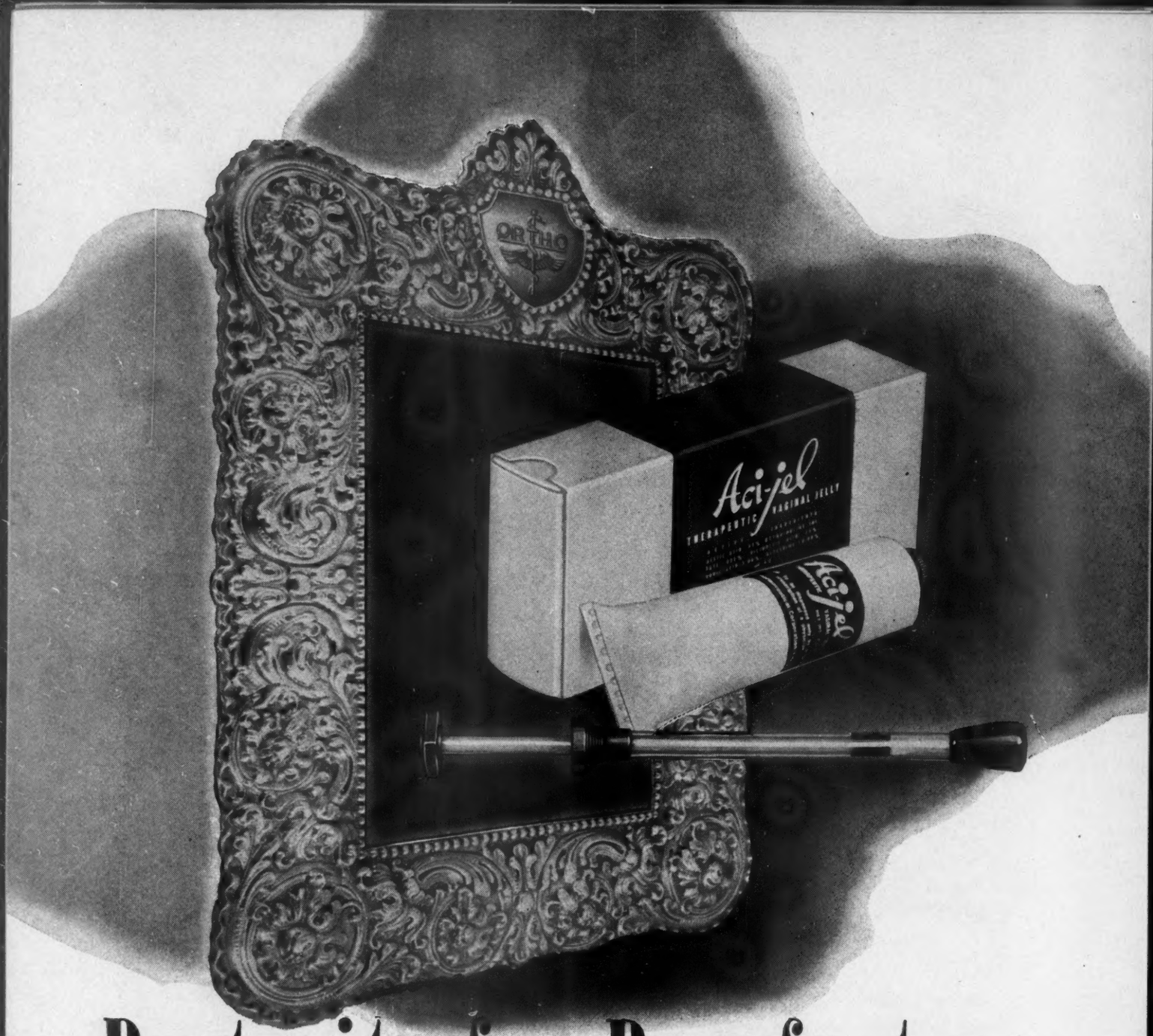

Portrait of a Benefactor..

IN SOUND VAGINAL THERAPY

Sound vaginal therapy should logically include restoration of correct hydrogen ion concentration, since "vaginal pH is the strongest immediate factor determining the type of organisms present in the vaginal tract".* *Pathogens are less likely to survive in the vagina if the pH is acid*... within the range of pH4 to pH5.

Aci-Jel, a water-miscible, bland, buffered *acid jelly*, fulfills all the criteria for simple, direct, effective acid therapy of non-specific vaginal infections. Non-irritating, it may be used safely in prolonged therapy.

***Rakoff, A. E., Feo, L. G. and Goldstein, L.: Am. J. Obst. & Gynec., 47:467, April 1944.**

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FOR VAGINAL INFECTIONS Aci-jel

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The American Journal of Surgery

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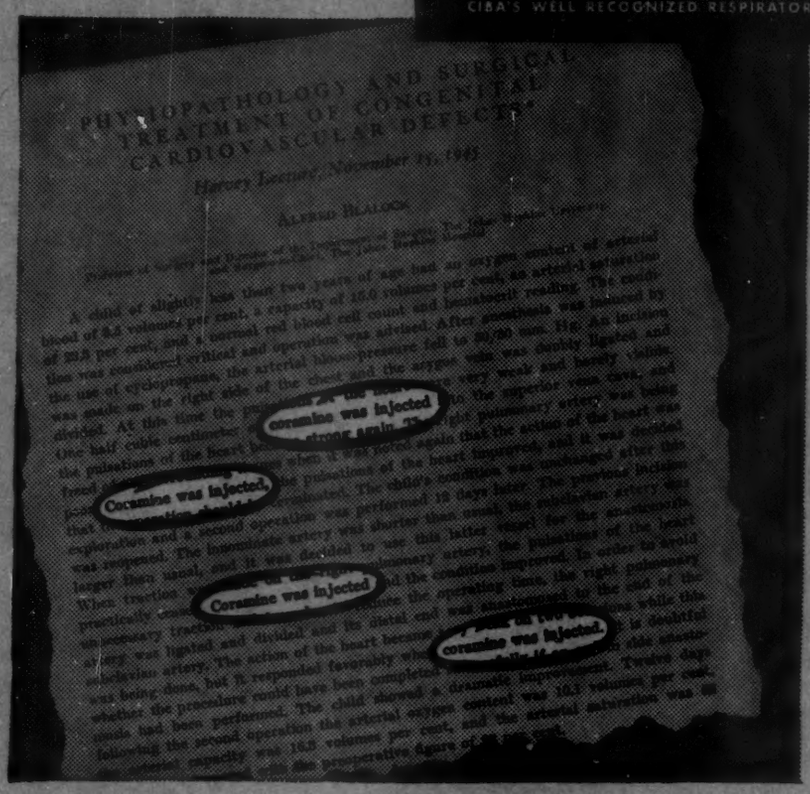
CIBA'S WELL RECOGNIZED RESPIRATORY STIMULANT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During prolonged surgery in poor risk patients it is not unusual for Coramine to be used several times. The number of such reports indicating dramatic life-saving results is very gratifying to the surgeon who has learned to depend on Coramine in such emergencies.

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16 ounce bottle
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